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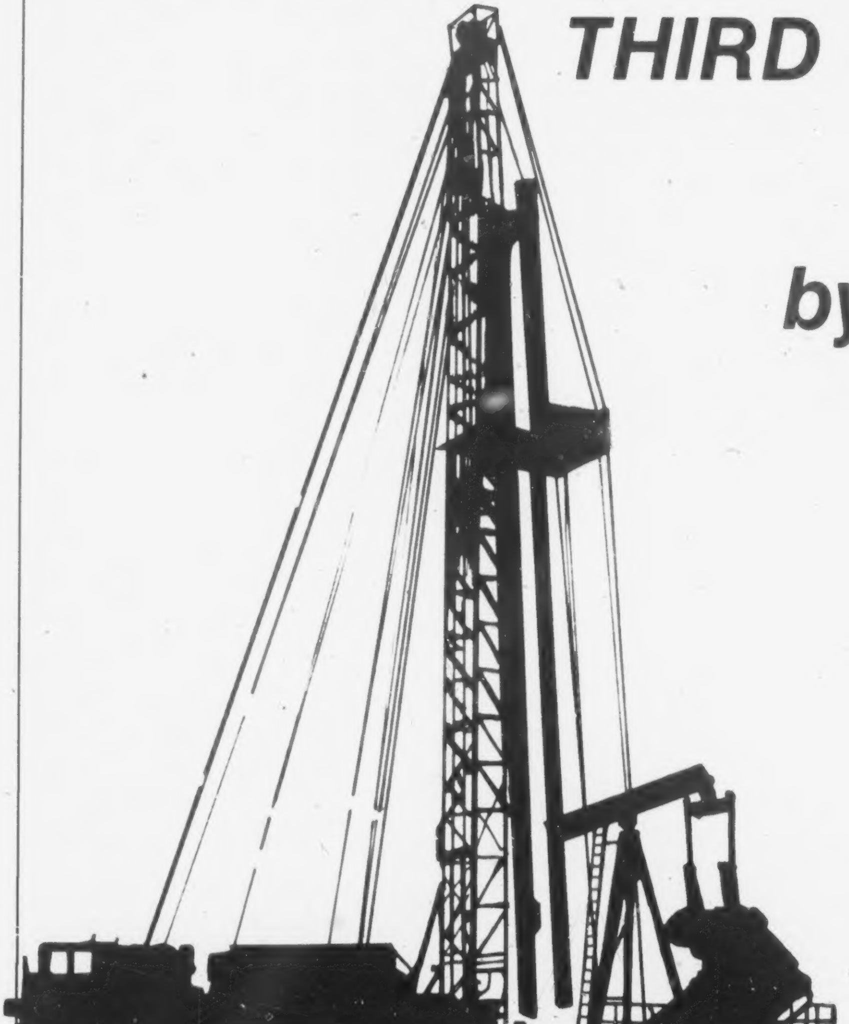
OIL INDUSTRY OUTLOOK

THIRD EDITION

by Robert J. Beck



OIL INDUSTRY OUTLOOK
Third Edition
by Robert J. Beck, Economics Editor, *Oil & Gas Journal*

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FOREWORD

WE ARE LIVING in the era of the first truly global economy.

Isolation is dead. The Iron Curtain has rusted out. Bilateral trade is a dominant factor in the economic strategy of almost all countries.

Population growth is declining in the developed countries, but is being more than offset by the burgeoning gains in the developing countries of Asia, Africa, and Latin America.

Structural and financial inequities between the OECD countries and the LDCs still prevail—but the pendulum is inexorably swinging.

Economic growth, of course, plays a major role relative to the degree that individual countries can exploit their natural resources and labor cost differentials.

The world is in a period of oversupply right now in terms of the availability of most of our primary requirements, be they raw materials or finished goods.

Accessibility on an equitable basis, however, is not universal. As an example, food production is more than adequate, distribution is the bottleneck. Three of the world's largest countries—China, the Soviet Union, and the United States—could be significantly dependent, in the future, for indigenous oil and gas supply and revenues from remote, inhospitable areas of their territory.

The quantum technological improvement in pre-eminent industries such as agriculture and transportation has changed age-old trading patterns.

Within this overall economic framework, the production and consumption of energy continues to be a pivotal ingredient. As an example, the current low energy prices reflect a surplus supply situation that eventually will benefit the developing countries inhabitants more in the long run than those in North America and Europe. This 20th century is now more than 85% complete—during this period we've experienced two world wars and a world economic depression.

In just the last ten years we've had unprecedented population changes among the world's continents, as well as a global upheaval in the consumption and cost of energy. Over that timespan, world oil consumption went from 56 MMB/D in 1975 to 59 MMB/D in 1985—after peaking at 64 MMB/D in 1979.

The geographical share of the total market has changed, even more dramatically, with the OECD countries dropping from 66% to 57% (−3.0 MMB/D) in the 1975–85 period. LDCs rose from a 15% to a 20% share (+3.5 MMB/D), while the Communist countries increased their oil usage from 20% to 23% of the total (+2.3 MMB/D).

There has also been a significant shift in the market share of the primary energy fuels over the same 1975–1985 period. In 1975, oil held a 46% share while coal was next with 29% share, then natural gas with 18%, hydro with 6%, and nuclear with 1%. In 1985, oil's market share had fallen to 38%, coal 30%, natural gas 20% and hydro 7% all improved their market share slightly while nuclear now held almost 5%.

At present, the supply of all energy fuels exceeds demand requirements. The cost of crude oil has gone from $8/bbl in 1976 to $32/bbl in 1981 and has fallen back to the $8/bbl level again in 1986.

Who would be willing to wager that the remainder of this century could see the same magnitude of price volatility? Maybe not, but certainly the same pattern is not beyond the realm of possibility.

In the last ten years, we have heard the Pollyannas speculate that solar and geothermal power was the answer to alleviating potential energy shortages.

We have also heard the Cassandras postulate that the cost and/or precipitous decline in oil and gas production would eventually lead to their demise as the primary components of world energy use.

We have also been told that coal and nuclear-generated electricity could be the fastest growing energy source in the future, but what about the acid rain controversy and what about the Chernobyl implications? Energy demand forecasting may have been a relatively simple exercise back in the 1960s when growth was constant, inter-fuel competition was not a significant factor, prices were stable, and oil trading followed a general pattern.

In today's frenetic atmosphere, there still remain some parochial trends in energy consumption just as there are seasonal and sectoral ones; but the principal difference between then and now is that the number of players has increased dramatically as has the volume traded.

Having said all this. . .If you are a subscriber to the philosophy that the best surprise is no surprise, then this is certainly not a propitious time to be earning your living as a forecaster of energy demand. If forecasting is your game—frustration may be your name!

Here we are in autumn 1986 with the real cost of oil back to about the same level it was in 1973, after a stimulating and at times startling roller coaster ride.

Assuredly, you can make a case that the whole period since 1973 has been fraught with the perils of prognostication. Indeed, the demand path for both oil and gas consumption in the last ten years looks more like a knuckleball than a curve.

Nevertheless, stepping into the batter's box on the following pages is the *Oil & Gas Journal's* intrepid forecaster—with a perspicacious outlook for the petroleum industry.

Charles Gallagher

INTRODUCTION

THE WORLDWIDE and U.S. domestic oil and gas industry is continuing to undergo a major transition. The industry is being reshaped by new and changing economic and political events. Profitable survival by those in the industry is dependent upon being aware of these changes and how they will shape the future, and dependent upon constructing some logical view of future industry trends.

After sliding downward for over four years, the price of crude oil fell precipitously in early 1986. The price fell to levels that most industry observers would have never expected to see again. Where and if the price will settle are still questions that are unanswered.

The industry is still faced with massive excess crude production capacity. It is still uncertain when this overhanging surplus will be eliminated and alleviate the downward pressure on prices. The shift in control of the level of total worldwide crude oil production to OPEC has resulted in a much less predictable industry.

At these significantly lower price levels, the level of non-OPEC production will be adversely affected. Development of high cost non-OPEC reserves will be diminished and/or delayed. The impact on U.S. domestic exploration and production is expected to be severe, but the pace of this adjustment to lower prices in non-OPEC countries is still uncertain.

Exploration and development drilling in the U.S. hit a record low in the summer of 1986. But drilling costs have been declining, and if prices stabilize there could be a turnaround in drilling activity in the future.

Product prices have taken a plunge along with crude oil prices. In response to the lower prices, demand for petroleum products has started to move upward more rapidly than anticipated. The extent of the surge in demand will undoubtedly depend upon the future level of prices. If demand continues to move up, it could go a long way toward significantly closing the surplus production gap.

The refining sector of the industry is also still faced with an excess capacity problem. However, increasing demand could also go a long way toward resolving that problem. And refiners found profits in a new form of crude oil pricing—netback pricing. This enabled them to increase and maintain profits while the product prices were falling rapidly. Whether these types of contracts will be offered in the future or become a permanent fixture is uncertain.

This is only a partial list of events that are presently reshaping the industry and that will have a profound impact on the future of the industry, and uncertainty is the key word.

Uncertainty is not new in the oil industry or elsewhere. Any philosopher will tell you, "The only thing certain in life is uncertainty." Anyone close to the oil industry will tell you that the only thing certain about the oil industry is uncertainty. Well, uncertainty and risk.

The entire foundation for making projections, forecasts and decisions is unstable. About the only thing that is certain is that the future industry will not look like the past industry, and that means any new investment entails substantial risk.

Even in the face of all this uncertainty, forecasts have value. Forecasts are a valuable, essential tool for decision making. The 'bottom line' for the forecasting industry is a better decision. As bad as industry projections have been in the past, it is essential that they continue to be developed. The more information obtained to assist operating and investment decisions, and the clearer the understanding of potential future events that will affect the industry, the more likely that a decision will make a positive contribution to a company's performance. A decision is seldom, if ever, 100% right or wrong. The outcome is usually some gradation of right or wrong. Any information that can improve the decision and increase the overall return on the company's investment is a valuable addition.

Forecasts and projections can be useful tools that help reduce risk. But in order to be a useful tool, a forecast must be based on an understanding of recent events and their affect on the industry. It must be internally logical and consistent, and it must use tried and tested economic theory as a framework.

Political, noneconomic events can upset the best forecast. But if a forecast is to be an aid in decision making, it must be based on known economic relationships rather than imagined future political events.

The industry is changing, but the outcome is still determined by basic economic principles. Recent events may be shaping the future industry, but historical relationships should not be discarded without reliable proof of the change.

Yes, any forecast must be founded on a set of assumptions. What is essential is that the basic assumptions used and conclusions drawn are logical, that they hold together based on an understanding of the industry, and that they reflect the actual workings of the industry and economic system.

This outlook booklet has been developed to provide industry decision makers and analysts with a number of items. It is first an outlook for the worldwide and domestic oil and gas industry for the next five years. It is also a review of recent events that have had a major impact on the industry. And it is a guide to the factors to consider when preparing your own forecast for decision making. It points out the factors that are essential and must be taken into consideration when making decisions for the future industry.

In addition, the booklet provides the essential oil and gas industry historical data for additional individual analysis. This enables the adoption of an alternative set of assumptions and the development of alternative outlooks. Although a decision must be based on one perception of the future, a set of alternative assumptions and forecasts often aids decision making.

It is essential that companies develop a strategy for adapting to the changes occurring in the industry and a strategy for operating under the new conditions in the industry. The strategy that worked in the 1970s, in terms of business practices, will not necessarily work in the 1980s, or in the 1990s.

This outlook booklet and future editions will be of assistance in clarifying recent events and trends, and providing a logical and consistent outlook.

The future may be filled with uncertainty, but it is also filled with exciting opportunities. The only way to take advantage of opportunities is to make decisions and take risks. This booklet will help reduce risks and make the decisions more profitable.

WORLDWIDE OUTLOOK—DEMAND

WORLDWIDE OUTLOOK—DEMAND

THE FIRST PORTION of the outlook will be a close look at the worldwide oil industry. Understanding what is presently occurring in the U.S. oil industry is definitely dependent upon understanding recent events and trends in the worldwide oil industry. Substantial consideration must be given to the impact of worldwide economic and energy industry events on events in the U.S. The U.S. oil industry is very closely interrelated with the worldwide oil industry.

The first step will be to take a look at past and recent trends in worldwide demand for petroleum products. This followed by a presentation of the logical expectation/outlook for worldwide demand for energy and petroleum products.

The level of worldwide economic activity is the key determinant of energy and oil demand. Energy is one of the essential inputs for all economic activity, and therefore there is an extremely close relationship.

Oil and natural gas are two of the basic energy sources, providing a substantial proportion of total energy consumed. Therefore, demand for oil and natural gas is also closely related to the level of economic activity.

The rapid increase in the cost of oil radically changed the relationship between economic growth and energy.

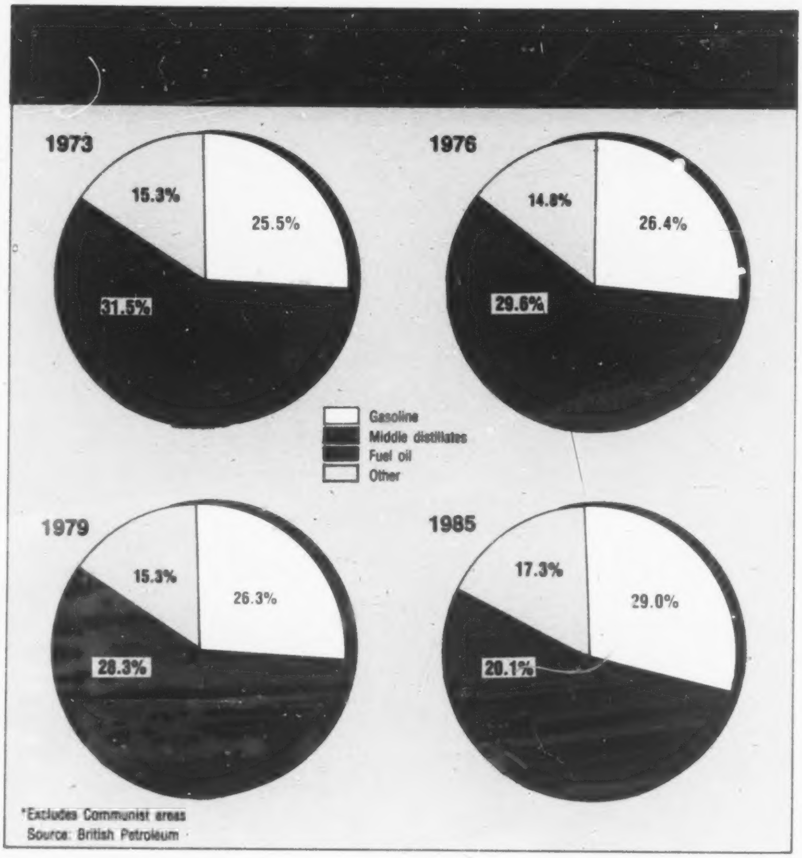
The price of energy in general and the individual forms of energy, such as oil and natural gas, also plays a major role in determining the level of demand. The relationship between economic activity and energy consumption has been altered dramatically over the past ten to fifteen years. The rapid increase in the cost of oil, and energy in general, broke the lock-step relationship between economic growth and energy consumption. With much higher prices for energy and petroleum products, conservation became a dominant consideration when consuming energy, and oil in particular. These changing relationships are presented in the following review and outlook.

It should also be pointed out that oil products are consumed throughout the world in a wide variety of areas with differing levels and types of economic activity. Oil products are consumed throughout the world, in the industrial economies, the developing economies, and the centrally-planned economies of the communist countries. Petroleum product demand in all of these areas has been taken into consideration. Demand for oil products and natural gas to fuel economic activity in all areas of the world is the determinant of the level of all activity in the oil industry.

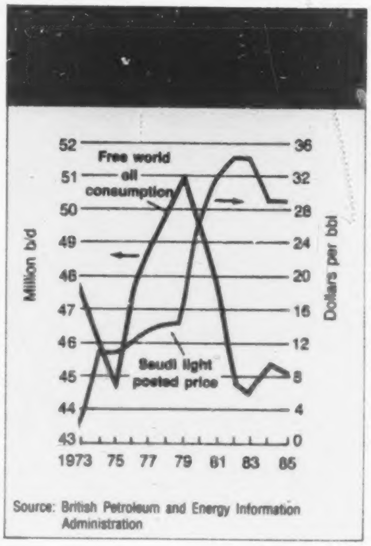
Review

As mentioned, the level of worldwide economic activity is the key determinant of energy demand. There is no aggregate measure of overall world economic activity. But there are some regional measures, particularly for the industrial countries. Aggregate economic activity is measured for the countries in the Organization for Economic Cooperation and Development (OECD). This is a group of 24 industrial countries.

Over the period of 1972 to 1982, aggregate real economic growth for the total group of countries averaged 2.5% per year. The most



*Excludes Communist areas
Source: British Petroleum



Source: British Petroleum and Energy Information Administration

WORLDWIDE PETROLEUM PRODUCT MARKET SHARE

	1973 %	1976 %	1979 %	1982 %	1984 %	1985 %
U.S. and CANADA						
Gasoline	37.6	38.5	37.3	41.5	41.8	41.9
Middle distillates	25.2	25.7	27.0	26.9	28.1	28.5
Fuel oil	18.4	18.0	17.1	12.9	10.4	9.1
Other	18.8	17.8	18.6	18.7	19.7	20.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
WESTERN EUROPE and JAPAN						
Gasoline	17.2	18.5	19.5	21.4	22.3	22.9
Middle distillates	29.4	30.8	32.0	33.8	36.1	37.6
Fuel oil	40.5	38.3	35.4	29.8	25.8	23.8
Other	12.9	12.4	13.1	15.0	15.8	15.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
REST OF WORLD*						
Gasoline	19.1	18.6	18.9	19.3	19.5	19.5
Middle distillates	29.0	32.7	32.2	34.0	35.1	35.4
Fuel oil	37.8	34.6	35.3	32.8	30.7	29.9
Other	14.1	14.1	13.6	13.9	14.7	15.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
TOTAL WORLD*						
Gasoline	25.5	26.4	26.3	28.1	28.6	29.0
Middle distillates	27.7	29.2	30.1	31.4	32.9	33.6
Fuel oil	31.5	29.6	28.3	24.5	21.5	20.1
Other	15.3	14.8	15.3	16.0	17.0	17.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

*Excludes communist areas

Source: British Petroleum

recent economic recession hit a trough in most of the industrial countries during the fourth quarter of 1982. Aggregate economic activity for the OECD was down 0.3% in 1982.

An upturn in economic activity started slowly in 1983. Real economic growth for the OECD group was 2.7% in 1983. The rate of growth accelerated in 1984, and the OECD total economic activity increased 4.9%. Economic growth slowed a bit in 1985 with OECD aggregate activity up an estimated 2.75%.

The U.S. economy led the way in 1983 and 1984. Real GNP in the U.S. increased 3.7% in 1983 and 6.8% in 1984. Japan followed with an increase of 3.4% in 1983 and 5.8% in 1984. Canada was next with growth rates of 3.3% in 1983 and 5.0% in 1984. As a group the four major European industrial countries, Germany, France, United Kingdom and Italy had a growth rate of 1.4% in 1983 and 2.4% in 1984.

Japan led the way in 1985 with a growth rate of 5% followed by Canada with a growth rate of 4%. U.S. GNP moved up 2.2%. The four major European countries posted economic activity up 2.25%.

The rate of aggregate economic activity in 1986 is estimated at about the same level as 1985 for the OECD at 2.75%. Japan will lead the way among the OECD countries at 3.5%, followed by Germany at 3.25%. U.S. economic activity is expected to increase 2.5%. The four major European countries are expected to move up 2.5%.

The lower energy prices, however, are expected to stimulate economic growth in the latter part of 1986 and into 1987. Lower oil prices will be particularly stimulative to the developing countries, which rely heavily on imported oil to fuel their economies.

Lower energy costs will stimulate economic growth.

Overall economic activity for the entire world is expected to increase 3.1% in 1986 and an estimated 3.5% in 1987 as lower energy costs stimulate demand. Offsetting the lower energy prices will be the depressing impact of huge budget deficits, huge worldwide debt and growing protectionism. This will slow economic growth in 1989.

However, it is expected that ample adjustments will be made in the worldwide economy to stimulate growth again in the latter part of the forecast period. One of the keys to economic growth is the level of private investment that can be generated. And the keys to generating private investment in economic growth are controlling inflation and minimizing the burden of government debt. Long-range expectations are for free-world economic growth at the rate of 3% per year.

As stated earlier, the relationship between economic growth and energy has changed markedly. Price-induced conservation has reduced energy consumption throughout the industrial world. This has been more pronounced in recent years, following the 1978–79 oil price hike. In developing areas, conservation of energy has not been as evident as in industrial areas. In these developing areas, industrialization is still the major economic policy objective and supersedes attempts at conservation.

The ratio of energy to gross economic output can be expected to continue to fall worldwide, but particularly in the industrial areas. However, the substantially lower energy prices should slow conservation efforts and the change in this ratio. This will be particularly true in those areas where lower energy costs are passed through to the consumer.

World primary energy consumption has been on the rise again in recent years. Total world energy consumption moved up 2.6% in 1985 to a peak of 54.3 billion barrels of oil equivalent.

World primary energy consumption moved up steadily to 50.9

WORLDWIDE PRIMARY ENERGY CONSUMPTION AND MARKET SHARE

	1974	% of total	1976	% of total	1978	% of total	1979	% of total	1980	% of total	1982	% of total	1984	% of total	1985	% of total
	(Million barrels oil equivalent)															
Oil	20,234	46.4	21,217	46.0	22,598	46.0	22,907	45.0	21,980	43.4	20,461	40.6	20,693	39.1	20,593	37.9
Natural gas	7,976	18.3	8,398	18.2	8,899	18.1	9,405	18.5	9,588	18.9	9,746	19.4	10,585	20.0	10,935	20.1
Coal	12,396	28.4	13,086	28.4	13,641	27.7	14,431	28.3	14,677	29.0	14,998	29.8	15,946	30.1	16,696	30.7
Water power	2,519	5.8	2,627	5.7	2,926	6.0	3,058	6.0	3,134	6.2	3,361	6.7	3,614	6.8	3,652	6.7
Nuclear	457	1.1	770	1.7	1,096	2.2	1,121	2.2	1,240	2.5	1,794	3.5	2,137	4.0	2,471	4.6
Total*	**43,582**	**100.0**	**45,098**	**100.0**	**49,160**	**100.0**	**50,922**	**100.0**	**50,619**	**100.0**	**50,360**	**100.0**	**52,975**	**100.0**	**54,347**	**100.0**

*Excludes miscellaneous fuels not mentioned specifically

Source: British Petroleum

WORLDWIDE OIL CONSUMPTION

Country/Area	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	% change 85/73	% change 85/79
	(1,000 b/d)																				
NORTH AMERICA																					
U.S.*	12,275	13,085	13,815	14,350	14,845	15,990	16,870	16,150	15,875	16,980	17,925	18,255	17,910	16,460	15,550	14,765	14,745	15,175	15,170	-10.1	-15.3
Canada	1,285	1,375	1,440	1,525	1,585	1,655	1,755	1,785	1,735	1,790	1,810	1,835	1,915	1,855	1,760	1,565	1,475	1,425	1,470	-16.2	-23.2
Total North America	**13,560**	**14,460**	**15,255**	**15,875**	**16,430**	**17,645**	**18,625**	**17,935**	**17,610**	**18,770**	**19,735**	**20,090**	**19,825**	**18,315**	**17,310**	**16,330**	**16,220**	**16,600**	**16,640**	**-10.7**	**-16.1**
WESTERN EUROPE																					
Austria	130	150	160	185	205	215	235	210	215	230	225	240	250	245	225	210	205	200	200	-14.9	-20.0
Belgium & Luxembourg	390	440	500	560	570	620	635	560	535	560	565	585	560	540	500	475	435	420	420	-33.9	-25.0
Denmark	245	275	330	365	365	385	360	320	315	335	330	325	320	275	260	225	215	210	220	-38.9	-31.3
Finland	145	165	190	210	220	235	260	230	235	255	250	250	265	255	245	230	215	215	220	-15.4	-17.0
France	1,360	1,470	1,705	1,920	2,090	2,315	2,585	2,460	2,255	2,430	2,350	2,445	2,435	2,260	2,060	1,915	1,880	1,815	1,785	-30.9	-26.7
Greece	115	115	125	135	150	170	200	185	195	210	215	230	250	250	240	240	230	235	245	22.5	-2.0
Iceland	10	10	10	10	10	10	15	15	10	10	10	10	15	10	10	10	10	10	10	-33.3	-33.3
Republic of Ireland	60	70	75	80	90	100	110	110	105	105	115	125	130	120	105	95	85	85	80	-27.3	-38.5
Italy	1,255	1,385	1,530	1,740	1,875	1,965	2,070	[illegible]	1,895	2,065	1,920	2,015	2,080	1,970	1,940	1,845	1,820	1,735	1,745	-15.7	-16.1
Netherlands	550	590	650	725	720	805	835	72[illegible]	710	795	770	795	855	800	745	655	625	625	640	-23.4	-25.1
Norway	120	135	150	165	165	170	175	160	165	180	180	195	200	200	190	180	180	190	190	8.6	-5.0
Portugal	65	70	80	95	115	120	130	135	140	145	150	150	165	170	180	195	195	195	170	30.8	3.0
Spain	410	435	495	565	635	655	790	820	865	970	930	955	1,015	1,070	1,040	990	1,010	955	945	19.6	-6.9
Sweden	420	470	530	590	560	565	585	540	535	590	560	535	570	500	445	440	375	345	350	-40.2	-38.6
Switzerland	190	210	230	260	275	280	300	270	260	270	270	280	270	270	250	235	260	250	260	-13.3	-3.7
Turkey	115	130	140	155	180	200	250	255	275	310	340	315	300	300	315	335	330	370	390	56.0	30.0
United Kingdom	1,735	1,840	1,980	2,095	2,105	2,230	2,300	2,135	1,875	1,860	1,885	1,930	1,945	1,670	1,560	1,580	1,530	1,850	1635	-28.9	-15.9
West Germany	1,895	2,135	2,420	2,655	2,745	2,885	3,070	2,760	2,655	2,855	2,855	2,960	3,050	2,725	2,465	2,355	2,340	2,330	2,410	-21.5	-21.0
Total Western Europe	**9,210**	**10,095**	**11,300**	**12,510**	**13,075**	**13,925**	**14,905**	**13,905**	**13,240**	**14,175**	**13,920**	**14,340**	**14,675**	**13,630**	**12,775**	**12,210**	**11,940**	**12,035**	**11,915**	**-20.1**	**-18.8**
AUSTRALASIA																					
Australia	410	455	485	510	535	540	590	610	605	630	655	655	665	630	625	610	590	610	590	—	-11.3
New Zealand	65	70	70	85	85	90	95	95	90	95	95	95	90	90	85	85	80	85	80	-15.8	-11.1
Total Australasia†	**475**	**525**	**555**	**595**	**620**	**630**	**685**	**705**	**695**	**725**	**750**	**750**	**755**	**720**	**710**	**695**	**670**	**695**	**670**	**-2.2**	**-11.3**
Japan	2,465	2,850	3,390	4,000	4,435	4,735	5,460	5,270	5,020	5,190	5,350	5,420	5,485	4,935	4,695	4,395	4,390	4,565	4,320	-20.9	-21.2
Total OECD	**25,710**	**27,930**	**30,500**	**32,980**	**34,560**	**36,935**	**39,675**	**37,815**	**36,565**	**38,860**	**39,755**	**40,600**	**40,740**	**37,600**	**35,490**	**33,630**	**33,220**	**33,895**	**33,545**	**-15.5**	**-17.7**
Cyprus/Gibraltar/Malta	15	20	20	20	25	25	25	25	20	25	25	25	30	30	30	30	30	35	35	40.0	16.7
Latin America	2,195	2,325	2,510	2,645	2,820	3,060	3,355	3,495	3,520	3,570	3,820	3,975	4,230	4,400	4,435	4,540	4,450	4,420	4,430	32.0	4.7
Middle East	755	795	920	965	1,055	1,115	1,210	1,320	1,320	1,475	1,565	1,620	1,495	1,625	1,780	1,875	1,915	1,980	1,980	63.6	32.4
Africa	700	735	795	855	900	920	1,010	1,035	1,050	1,155	1,205	1,290	1,360	1,450	1,540	1,595	1,620	1,665	1,715	69.8	26.1
Southeast Asia	415	455	535	540	565	585	635	600	610	665	705	760	775	825	890	935	950	1,030	1,095	72.4	41.3
South Asia	715	830	905	1,030	1,135	1,285	1,465	1,510	1,535	1,675	1,805	2,015	2,280	2,325	2,375	2,300	2,310	2,315	2,295	56.7	0.7
Total Non-Communist World	**30,505**	**33,090**	**36,185**	**39,035**	**41,060**	**43,925**	**47,375**	**45,800**	**44,620**	**47,425**	**48,880**	**50,285**	**50,910**	**48,255**	**46,540**	**44,905**	**44,495**	**45,340**	**45,095**	**-4.8**	**-11.4**
COMMUNIST																					
China	275	300	400	560	725	855	1,065	1,225	1,350	1,530	1,630	1,705	1,835	1,765	1,705	1,660	1,705	1,750	1,760	65.3	-4.1
U.S.S.R.	4,250	4,515	4,815	5,310	5,655	6,115	6,595	7,280	7,520	7,780	8,125	8,480	8,640	8,795	8,985	9,115	9,035	8,895	9,060	37.4	4.9
Others	1,090	1,200	1,400	1,535	1,715	1,870	2,010	2,090	2,235	2,430	2,595	2,675	2,755	2,730	2,625	2,575	2,490	2,495	2,550	26.9	-7.4
Total Communist	**5,615**	**6,015**	**6,615**	**7,405**	**8,095**	**8,840**	**9,670**	**10,595**	**11,105**	**11,740**	**12,350**	**12,860**	**13,230**	**13,290**	**13,315**	**13,350**	**13,230**	**13,140**	**13,370**	**38.3**	**1.1**
Total World	**36,120**	**39,105**	**42,800**	**46,440**	**49,155**	**52,765**	**57,045**	**56,395**	**55,725**	**59,165**	**61,230**	**63,145**	**64,140**	**61,545**	**59,855**	**58,255**	**57,725**	**58,480**	**58,465**	**2.5**	**-8.8**

*U.S. processing gain has been deducted from local domestic product demand. †Includes Australia and New Zealand

Source: British Petroleum

Primary energy consumption has been on the rise in recent years.

billion barrels of oil equivalent in 1979. During the ten-year span, 1969–1979, world energy consumption increased 51.6%, or at an average annual rate of about 4.2% per year. However, following the sharp increase in energy costs in the 1970's and early 1980's, a conservation effect was felt and energy consumption leveled off and fell. Energy consumption fell 1.1% between 1979 and 1982 to 50.4 billion barrels.

As energy prices began to slide, consumption increased, moving up 1.2% in 1983. Still lower energy prices and more vigorous economic growth helped boost energy consumption another 3.9% in 1984. It again moved up in 1985 to a record high 54.3 billion barrels of oil equivalent.

Most of the energy conservation took place in the non-communist countries. During the period 1979 through 1982, energy consumption fell 3.9%, from 34.7 billion barrels oil equivalent to 33.3 billion barrels in the non-communist countries.

Energy consumption in the non-communist countries began to move up again as prices moderated, increasing 0.3% in 1983, 4.3% in 1984 and 1.4% in 1985. This is an increase of 6.1% over the three-year period. Energy consumption reached a record 35.4 billion barrels in 1985.

The conservation effect had the biggest impact on the industrial countries with energy-intensive economies. Between 1979 and 1983, U.S. energy consumption fell 10.2%, Western Europe energy consumption fell 8.5% and Japanese energy consumption fell 7.8% from 1979 to 1982. Most of these countries were highly dependent upon oil to fuel economic growth, and the huge increase in oil prices provided substantial incentive for conservation.

Even with moderately lower energy prices, growth in energy consumption has been modest in these industrial areas over the 1982 through 1985 period. U.S energy consumption in 1985 was down 0.5% from 1984, but up 4.7% from 1983. Western European energy consumption in 1985 was up 4.9% from 1983. Japanese energy consumption in 1985 was down 1.2% from 1984, but up 7.1% from 1982.

With the upswing in overall economic activity, energy consumption can be expected to increase over the forecast period. Conservation will continue to dampen demand, but this should be offset by the effect of lower prices and economic growth. The substantially lower energy prices which the world is now experiencing should severely diminish the conservation effort and boost energy consumption.

Conservation had the biggest impact on energy consumption in the industrial countries.

There has been a substantial shift in the market share of the various forms of primary energy. Over the period 1972 through 1983, oil's share of total worldwide primary energy fell from 46% to 40.3%. It then dropped to 39.1% in 1984, and 37.9% in 1985.

Although there have been year-to-year fluctuations in relative market shares, all other primary fuels gained market share at the expense of oil over this period. Natural gas moved up from 18.6% in 1972 to 20.0% in 1984, and 20.1% in 1985. Coal increased from 28.9% in 1972 to 30.1% in 1984 and 30.7% in 1985. Nuclear power supplied only 0.7% of total energy in 1972, but moved up to 4.0% in 1984 and 4.5% in 1985. Hydroelectric power contributed 5.8% in 1972, 6.8% in 1984 and 6.7% in 1985.

The rapid rise in the price of oil relative to other fuels led to fuel switching. This was particularly true for heavy industry and electric utilities. With the high price, oil became the "swing fuel," supplying energy when other fuels were not available. Total world energy

WORLDWIDE PRIMARY ENERGY CONSUMPTION

Country/Area	1973	1976	1979	1982	1984	1985	% change 85/73	% change 85/79
	(Million barrels oil equivalent)							
NORTH AMERICA								
U.S.	13,288.6	13,216.7	14,031.1	12,665.5	13,251.2	13,189.6	-0.7	-6.0
Canada	1,399.3	1,515.1	1,625.8	1,575.2	1,597.9	1,661.0	18.7	2.2
Total North America	**14,687.9**	**14,731.8**	**15,656.9**	**14,240.7**	**14,849.1**	**14,850.6**	**1.1**	**-5.1**
WESTERN EUROPE								
Austria	174.5	173.7	193.5	178.9	179.6	186.9	7.1	-3.4
Belgium & Luxembourg	372.4	365.0	374.6	337.2	339.4	344.5	-7.5	-8.0
Denmark	144.4	140.7	147.3	122.4	123.1	135.6	-6.1	-7.9
Finland	131.2	134.9	158.3	156.9	159.1	165.7	26.3	4.7
France	1,364.1	1,342.9	1,414.0	1,332.6	1,370.0	1,387.6	1.7	-1.9
Greece	112.1	137.1	127.5	123.1	134.9	139.3	24.3	9.3
Iceland	15.4	15.4	13.9	11.0	11.0	11.7	-24.0	-15.8
Republic of Ireland	54.2	52.8	65.2	60.8	61.6	61.6	13.7	-5.5
Italy	1,010.8	1,046.0	1,097.3	1,029.9	1,024.7	1,031.3	2.0	-6.0
Netherlands	563.7	559.3	575.4	496.2	494.8	513.1	-9.0	-10.8
Norway	206.0	225.0	232.4	237.5	227.2	236.0	14.6	1.5
Portugal	66.0	64.5	82.8	90.9	92.4	88.0	33.3	6.3
Spain	423.7	494.0	552.7	554.9	576.9	576.9	36.2	4.4
Sweden	299.1	313.0	323.3	291.0	290.3	297.6	-0.5	-7.9
Switzerland	175.2	165.7	179.6	188.4	189.1	202.3	15.5	12.6
Turkey	131.9	166.4	171.5	203.0	222.8	243.4	84.5	41.9
United Kingdom	1,647.8	1,520.2	1,626.5	1,421.3	1,413.2	1,479.9	-10.2	-9.0
West Germany	1,941.6	1,902.9	2,103.8	1,829.5	1,907.2	1,959.2	0.9	-6.9
Total Western Europe	**8,834.1**	**8,819.5**	**9,439.6**	**8,665.5**	**8,817.3**	**9,060.6**	**2.6**	**-4.0**
AUSTRALASIA								
Australia	397.3	458.9	527.8	549.0	561.5	576.9	45.2	9.3
New Zealand	76.2	81.3	82.1	84.3	96.0	93.1	22.2	13.4
Total Australasia*	**473.5**	**540.2**	**609.9**	**633.3**	**657.5**	**670.0**	**41.5**	**9.9**
Japan	2,548.6	2,526.7	2,711.3	2,499.6	2,709.1	2,677.6	5.1	-1.2
Total OECD	**26,544.1**	**26,618.2**	**28,417.7**	**26,039.1**	**27,033.0**	**27,258.6**	**2.7**	**-4.1**
Cyprus/Gibraltar/Malta	10.3	9.5	11.0	11.7	13.2	14.7	42.7	33.6
Latin America	1,726.9	1,930.7	2,353.7	2,626.3	2,720.9	2,792.0	61.7	18.6
Middle East	638.4	751.3	787.2	957.3	1,059.9	1,055.5	65.3	34.1
Africa	719.1	862.0	1,106.1	1,331.1	1,384.6	1,430.1	98.9	29.3
South Asia	757.2	839.3	929.4	1,181.6	1,337.0	1,437.4	89.8	54.7
Southeast Asia	692.7	786.6	1,083.4	1,173.6	1,306.2	1,365.6	97.1	26.0
Total Non-Communist World	**31,088.7**	**31,797.6**	**34,688.5**	**33,320.7**	**34,854.8**	**35,354.1**	**13.7**	**1.9**
COMMUNIST								
China	2,657.1	3,206.1	3,931.8	3,834.3	4,313.7	4,649.4	75.0	18.3
U.S.S.R.	6,407.2	7,452.4	8,312.2	9,145.6	9,638.2	10,088.3	57.5	21.4
Others	3,161.4	3,642.3	3,989.0	4,059.4	4,168.6	4,255.1	34.6	6.7
Total Communist	**12,225.7**	**14,300.8**	**16,233.0**	**17,039.3**	**18,120.5**	**18,992.8**	**55.4**	**17.0**
Total World	**43,314.4**	**46,098.4**	**50,921.5**	**50,360.0**	**52,975.3**	**54,346.9**	**25.5**	**6.7**

*Includes Australia and New Zealand
Source: British Petroleum

WORLDWIDE PETROLEUM PRODUCT CONSUMPTION

	1973	1976	1979	1982	1984	1985	% change 79/73	% change 85/79	% change 85/73
	(Million barrels)								
U.S. and Canada	6,609.5	6,657.8	7,022.9	5,705.7	5,816.4	5,803.9	6.3	-17.4	-12.2
Gasoline	2,487.8	2,565.5	2,619.0	2,366.1	2,430.6	2,434.3	5.3	-7.1	-2.2
Middle distillates	1,663.2	1,712.3	1,893.3	1,537.1	1,633.9	1,655.1	13.8	-12.6	-0.5
Fuel oil	1,214.6	1,201.4	1,198.5	737.4	606.9	525.6	-1.3	-56.1	-56.7
Other	1,243.9	1,178.6	1,312.1	1,065.1	1,145.0	1,188.9	5.5	-9.4	-4.4
Western Europe and Japan	7,461.9	6,958.4	7,190.0	5,842.0	5,796.6	5,630.2	-3.6	-21.7	-24.5
Gasoline	1,285.7	1,285.7	1,399.3	1,250.5	1,290.8	1,290.8	8.8	-7.8	0.4
Middle distillates	2,196.1	2,144.0	2,300.2	1,976.9	2,092.7	2,114.7	4.7	-8.1	-3.7
Fuel oil	3,023.6	2,668.1	2,545.0	1,738.7	1,494.6	1,342.1	-15.8	-47.3	-55.6
Other	956.5	860.6	945.5	875.9	918.5	882.6	-1.2	-6.7	-7.7
Rest of World*	3,008.2	3,346.1	3,912.0	4,265.3	4,315.2	4,324.0	30.0	10.5	43.7
Gasoline	574.7	622.3	739.6	821.7	839.3	841.5	28.7	13.8	46.4
Middle distillates	872.3	1,093.6	1,257.8	1,452.1	1,515.8	1,530.5	44.2	21.7	75.5
Fuel oil	1,136.9	1,158.9	1,380.2	1,397.1	1,323.1	1,293.7	21.4	-6.3	13.8
Other	424.3	471.3	534.4	594.4	637.0	658.3	25.9	23.2	55.1
Total World*	17,079.6	16,962.3	18,124.9	15,813.0	15,928.2	15,758.1	6.1	-13.1	-7.7
Gasoline	4,348.2	4,473.5	4,757.9	4,438.3	4,560.7	4,566.6	9.4	-4.0	5.0
Middle distillates	4,731.6	4,949.9	5,451.3	4,966.1	5,242.4	5,300.3	15.2	-2.8	12.0
Fuel oil	5,375.1	5,028.4	5,123.7	3,873.2	3,424.6	3,161.4	-4.7	-38.3	-41.2
Other	2,624.7	2,510.5	2,792.0	2,535.4	2,700.5	2,729.8	6.4	-2.2	4.0

*Excludes communist areas
Source: British Petroleum

consumption moved up 31.8% over the 1972–1985 period, while energy from oil moved up only 8.4%.

The rapid rise in oil prices made the consumers, worldwide, oil energy cost-conscious. Where possible, fuel switching to less costly fuels took place. In general, energy costs had risen enough to become a major concern in the economics of industrial production and in the cost of living, and substantial price-induced conservation took place.

Oil's share of worldwide energy demand fell from 46% in 1972 to 38% in 1985.

During the next few years, oil's share of the total market will drop only marginally. The drop in crude prices has made oil more competitive with other fuel sources and also has slowed investment in conservation. Oil's share of the market may even increase and replace coal or natural gas in certain areas.

The rapid rise in the price of oil led to conservation and fuel switching.

Non-communist worldwide demand for oil products followed two distinct trends from 1972 through 1983. From 1972 through 1979, free-world demand was on the rise, increasing 14.8% over this seven-year span. From 1979 through 1983, demand for oil fell as price-induced conservation took over. Consumption dropped 13.8% over this four-year time period. The net effect was that free-world demand in 1983 was 1.1% below 1972. There was a reversal of this downward trend in 1984 as lower prices and economic activity boosted demand 2.0%. But demand fell 1.1% in 1985.

This could be the start of a new upward trend in oil demand. Substantially lower oil prices, particularly real oil prices adjusted for inflation, are expected to couple with increased economic activity to boost demand throughout the forecast period.

In addition to the price-induced conservation reducing demand through increased oil energy efficiency, fuel switching has had an impact. It has helped to reduce overall demand for petroleum products, and also changed the proportion of petroleum products consumed.

Oil consumption has followed two distinct paths: rising from 1972–1979, then falling from 1979–1983.

The impact of competitive fuels, coal, nuclear and water power is most evident in the consumption of heavy fuel oil. Consumption of heavy fuel oil in the non-communist world peaked in 1977 at 5.1 billion barrels. Demand has fallen for six consecutive years to 3.2 billion barrels in 1985, a drop of 38.3%. Demand in 1985 was down 7.7% from 1984.

Heavy fuel oil is the major petroleum product that is in the most direct competition with other fuels. Fuel oil consumption in the U.S. peaked in 1977, and has fallen 58.9% through 1985. Consumption in Western Europe peaked in 1976, and fell 49.8% through 1985. Japanese consumption fell 50.8% from 1977 through 1985. Consumption in the less-industrialized remaining areas of the non-communist world did not fall as sharply. Fuel oil demand in 1985 was down 8.8% from the peak in 1981.

However, lower fuel oil prices are making fuel oil more competitive with other forms of energy. This may actually increase the demand for fuel oil during the forecast period.

Gasoline consumption in the non-communist world peaked in 1978 and then fell sharply 7% to 4.4 billion barrels in 1982. Demand has moved up 2.9% to 4.6 billion barrels in 1985.

Demand in the U.S. peaked in 1978 and fell 13% by 1982, but then rebounded, increasing 3.5% from 1982 through 1985. Consumption in 1985 was down 10% from the peak.

The pattern of demand in Europe was similar. Demand peaked in 1979, fell 9.4% through 1981, but moved back up 3.2% through 1985. Demand in 1985 was down 6.5% from the 1979 peak.

Middle distillates demand also peaked in 1979 for the total non-communist world. Demand in 1985 was down 2.8% from the peak. But demand was up 6.7% from 1982.

The demand for all other petroleum products in 1985 was down only 2.2% from the peak in 1979.

In terms of petroleum product demand, there has been a major shift to a larger percentage of lighter products. As pointed out, the major reason has been the reduction in demand for fuel oil. But in addition, demand for middle distillates, motor gasoline and other products has held up fairly well.

Demand for petroleum products in the non-communist world peaked in 1979 at 18.1 billion barrels. This fell 13.1% to 15.8 billion barrels in 1985. The drop in fuel oil consumption accounted for 82.9% of the decline.

From a geographical perspective, the shift is most pronounced in the United States, Western Europe and Japan. In these areas there has been a major shift away from fuel oil and an increase in demand for gasoline and middle distillates. In the rest of the free world, the shift has not been as pronounced, but is also in evidence.

Over the ten-year period 1975 through 1985, the product demand mix has changed markedly.

In the U.S., the fuel oil share of the total barrel dropped from 16.9% in 1975 and 18.6% in 1977 to 9.2% in 1985. Gasoline moved up from 39.8% in 1975 to 42.1% in 1985. And middle distillates increased from 24.8% to 28.1%.

In Canada, the fuel oil share moved from 19.4% down to 8.3%. Gasoline consumption increased from 34.9% in 1975 to 40.5% in 1985. And middle distillates increased from 31.4% to 32.5%.

In Western Europe and Japan the drop in fuel oil demand was even more pronounced. In Europe, fuel oil demand dropped from 34.5% of the market in 1975 to 21.1% in 1985. Gasoline in Europe moved up from 19.1% to 23.9%. And middle distillates shifted from 33.7% to 39.7%. In Japan, fuel oil fell from 51.3% of oil product consumption in 1975 to 31.5% in 1985. Gasoline moved from 16.1% to 20.3%, and middle distillates from 20.7% to 31.6%.

Petroleum product demand has shifted to lighter products.

There are obvious geographical differences, with gasoline being a much greater share of the North American market, and fuel oil relatively more important but diminishing in importance elsewhere.

Looking at product consumption from the geographical perspective, what stands out most is the difference in trends between the industrial countries and the other, less-developed, countries. The consumption in the total U.S., Canada, Western Europe, and Japan, was down 10.6% in 1985 from 1975. For the remainder of the non-communist world, consumption in 1985 was up 38.3% from 1975.

Petroleum remains the primary energy source in the developing countries.

The alteration of the historical energy and economic activity relationship was primarily due to the rapid increase in the price of oil and other energy.

Oil, and to a certain extent all energy costs, increased more rapidly than other economic costs. This made energy a more important consideration in business decision making. The result was an adjustment in investment decisions with more concern for cost-cutting energy-saving investments.

This shift altered the emphasis of investment decisions; from investing for increased economic output for consumption, to an emphasis on energy cost cutting. This contributed to a drop in energy demand, but also slowed worldwide economic growth.

From 1972 to 1982, the posted price of Saudi Arabian marker crude

The price of crude oil jumped 1,271% from 1979 to 1982.

increased from $2.48/bbl to $34/bbl, an increase of 1,271% or $31.22/bbl. The real price adjusted for inflation increased 546%. This far surpassed the average price increase for all commodities of 151% over this period.

The sharp increase in prices did not initially slow demand for petroleum products. There is some evidence that the price of crude oil was below the market equilibrium price in the 1960's, and this encouraged demand. Therefore, the initial 1973–74 increase was easily absorbed. Another reason that demand did not appear to react to the initial price increase was that many energy and oil conservation investments take time to exert a measurable impact. In the industrial, utility and residential/commercial sectors, it may take up to 10 years or more before the majority of the impact from conservation investment is felt.

Adjustment to prices can be very rapid in the transportation sector of the economy. Much of the conservation is in the form of a change in discretionary driving habits. But there are also fewer substitutes for petroleum products in this sector, and this offsets some of the potential impact from higher prices.

Current prices levelled off after the initial price shock of 1973–74, and the real inflation-adjusted price fell. This muted the conservation adjustment to this price hike.

However, the 1979–80 price boost produced a much more dramatic adjustment. That price jump coupled with forecasts of future rapidly-rising oil prices led to a sharp drop in oil use.

Worldwide demand for petroleum fell 0.9% for each 10% increase in price.

Between 1978 and 1981, the world price of oil jumped another 152%. Responding to this rapid increase in prices, the demand for oil in the non-communist world peaked in 1979 and dropped 13.8% by 1983. Over this four-year period, the worldwide demand response to the price increase was a 0.9% drop in demand for every 10% increase in price. This is relatively inelastic demand. But it does show that there is a demand response to price that must be considered when estimating demand for oil products.

The drop in oil demand as a response to prices, and the worldwide economic slow-down, put downward pressure on crude prices. A massive crude production capacity surplus developed when demand fell. The result was a peaking of crude prices in March 1981. Although the official price of the OPEC marker Saudi light crude was boosted to $34/bbl in 1982, actual average transaction prices were falling.

The Saudi light crude marker price was lowered to $29 in early 1983, and again to $28 at the beginning of 1985. This is a 17.6% drop in the official marker crude price. The drop in actual transaction prices was even greater as more and more crude oil trading was based on spot market prices.

The lower crude oil prices had a small positive impact on demand in the non-communist countries. Demand moved up 2.0% in 1984, but slipped 1.1% in 1985.

It should be noted that the recent strong U.S. dollar relative to other currencies has resulted in oil prices being higher outside the U.S. Export crudes, particularly from OPEC, are denominated in U.S. dollars. In several European countries, oil prices, and therefore petroleum product prices, had actually risen from 1981 to 1985. That has tended to suppress demand for petroleum products in Europe and other areas in recent years.

Saudi Arabia reduces production preventing crude prices from falling between 1981 and 1985.

Prices were prevented from falling even more rapidly in the 1981–1985 period by the willingness of Saudi Arabia to support prices through a reduction in their production level.

Saudi Arabia abandoned their role of crude exporter of last resort in the fall of 1985 and decided on concentrating on a "fair share" of the market. This move exaggerated the excess availability problem and prices plummetted in February, March and April of 1986. The worldwide export price of crude oil fell over 50% to under $13/barrel.

This sharp drop in prices is expected to stimulate demand for oil, and slow investment in oil and energy conservation.

Outlook

The substantially lower oil and energy prices will stimulate worldwide economic growth during the forecast period 1987 through 1991. Sliding oil prices had helped boost economic activity over the 1983–1986 period.

Large budget deficits and debt problems, along with unemployment, plague some countries. Particularly the latter has led to a move toward protectionism. All of these have slowed economic growth recently. But a drop in energy prices of the magnitude experienced during the first half of 1986 should have a large stimulative impact on worldwide economic activity. This stimulation should prevent the world economy from slumping into a recession during the five-year forecast period.

Even with this boost from lower energy costs, worldwide economic activity will only move up about 3.1% per year over the forecast period. Economic growth is expected to be the strongest early in the period, before energy prices begin to move back up.

Worldwide economic activity will move up 3.1% per year over the forecast period.

The huge worldwide debt and deficit problem will slow economic growth during the middle of the forecast period, about 1989. However, by this time a way of alleviating the impact on economic growth will have been found and the result will only be a slowing of economic growth to around a 2.5% annual rate.

Continuing conservation will result in the energy growth rate being somewhat lower than the economic growth rate. However, the ratio of energy growth to economic growth will be much greater than in recent years. Over the next five years, consumption of low-cost energy will be driving economic growth. Energy consumption will increase at a rate of about 2.3% per year over the forecast period, but will vary with the pace of economic growth.

Due to the much lower nominal and real oil and petroleum product prices, the worldwide demand for oil will move up very closely to the rate of increase in energy demand. Conservation and substitution will continue in some economic sectors, but oil will also be regaining a portion of other energy markets. Fuel oil demand will reverse the trend of past years and move up over the forecast period.

Over the five-year forecast period, world oil demand is expected to increase 11.6%, an increase of 6.9 million barrels per day. Overall energy demand is expected to increase 11.9% over the same period. Non-communist oil demand will increase 11.4%.

World oil demand will increase 11.6% to 66.75 million b/d by 1991.

The increase in non-communist world demand will be led by a 13.7% increase in demand for middle distillates. Demand for motor gasoline is expected to increase 8.5% over the forecast period, led by a gradual increase in the U.S. Fuel oil will recapture some utility and industrial markets, due to the lower competitive prices.

Prices will not rebound to the pre-1986 levels during the forecast period. As demand increases, prices will stabilize at around $15 per barrel. As demand increases over the forecast period, prices will fluctuate with seasonal demand and move up gradually. Prices will begin to move up faster near the end of the forecast period as the gap between demand and available supply is closed. Real prices will move up over the forecast period from the low 1986 levels, but prices will not move back to pre-1986 levels, and will not slow economic growth markedly.

THE OUTLOOK — WORLDWIDE DEMAND

	1986	1987	1988	1989	1990	1991	Change 1986 to 1991	% change 1986 to 1991
World energy demand (million barrels oil equivalent)	55,595	57,045	58,295	59,465	60,890	62,230	+6,635	+11.9
World oil demand (thousand barrels/day)	59,810	61,365	62,715	63,905	65,310	66,750	+6,940	+11.6
Non-Communist demand (thousand barrels/day)	46,130	47,330	48,325	49,245	50,280	51,385	+5,225	+11.4
PETROLEUM PRODUCT DEMAND (thousand barrels/day)								
Non-Communist areas								
Motor gasoline	13,280	13,550	13,655	13,915	14,205	14,410	+1,130	+ 8.5
Middle distillates	15,585	16,080	16,550	16,865	17,220	17,720	+2,135	+13.7
Fuel oil	9,230	9,400	9,635	9,820	10,025	10,130	+ 900	+ 9.8
Other	8,035	8,300	8,485	8,645	8,830	9,125	+1,090	+13.6
Crude oil price (average world export price) ($/barrel)	14.00	16.00	17.00	18.00	20.00	22.00	+ 8.00	+57.1

WORLDWIDE OUTLOOK—SUPPLY

WORLDWIDE OUTLOOK—SUPPLY

SUPPLY is the other side of the equation that determines the outlook for the worldwide oil industry. And at the present time, it is the supply side that is dictating the level and type of activity in the worldwide industry.

The abrupt shift in OPEC policy from concentrating on supporting price to a policy of gaining production market share was the major reason for the sudden break in prices in early 1986. It was probably more accurate to label this as a shift in the Saudi Arabian policy that was adopted by OPEC. Saudi Arabia first signaled the shift when they announced their move to net-back pricing for some of their export sales.

This shift in policy greatly intensified the downward pressure on crude oil prices that eventually resulted in the steep decline in February, March, and April of 1986. Prior to this, the downward pressure due to the surplus worldwide crude capacity had been somewhat alleviated by the willingness of Saudi Arabia and a few other OPEC countries to cut production. This effort did not prevent the drop in prices, but it slowed the rate of decline.

Now, with little, if any, production discipline being enacted by any of the major exporting countries, there is a massive excess of crude oil available. And the result is lower prices than anyone would have dreamed of predicting five years earlier.

Review

Worldwide economic activity expanded greatly with little interruption throughout the 1950's, 1960's and into the 1970's. A substantial proportion of the economic activity and growth was fueled by crude oil. Worldwide production of crude oil expanded steadily throughout this period to meet the ever-increasing demand. New field development and capacity additions were sustained at a pace similar to that of economic growth and demand for oil.

The rapid rise in the price of oil in the 1970's and early 1980's led to oil and energy conservation throughout the worldwide economy, and slowed the demand for oil. Total hydrocarbon liquids production (crude oil, condensate and natural gas liquids) peaked in 1979 at 65.775 million barrels per day. Production in the non-communist world also peaked in 1979 at 51.28 million barrels per day. The second major price increase occurred in the 1979–1981 period and was the major reason for the decrease in consumption and production of oil that followed. Not only were conservation steps taken to reduce energy costs, but these adjustments led to a slow-down in economic activity, which contributed further to a drop in demand for oil.

World production fell four consecutive years, 1979–1983, dropping 13.8%.

World production fell for four consecutive years, 1979–1983, dropping to 56.685 million b/d in 1983. This was a drop in production of 9.09 million b/d, or 13.8%.

The drop in world crude production mirrored the drop in demand for petroleum products, which was a direct result of the sharp increase in the price of oil products, resulting from the OPEC crude price increases. In addition, there was a rapid shift to other energy sources

WORLDWIDE OIL RESERVES

	1974	1975	1976	1977	1978	1979	Jan. 1 1980	1981 —(1,000 bbl)	1982	1983	1984	1985	1986	Change 1986-1976	% change 1986/1976
Australia	2 300 000	2 300 000	1 700 000	1 380 000	2 000 000	2 100 000	2 130 000	2 360 000	1 709 000	1 622 077	1 586 000	1 430 900	1 449 000	251 000	14.8
Brunei	1 600 000	2 500 000	2 000 000	1 625 000	1 550 000	1 480 000	1 800 000	1 710 000	1 630 000	1 240 000	1 390 000	1 400 000	1 480 000	520 000	26.0
India	779 000	834 000	913 000	3 000 000	3 000 000	2 900 000	2 600 000	2 580 000	2 672 000	3 416 400	3 485 000	3 500 000	3 736 000	+ 2 823 000	+ 309.2
Indonesia	10 500 000	15 000 000	14 000 000	10 500 000	10 000 000	10 200 000	9 600 000	9 500 000	9 800 000	9 550 000	9 100 000	8 650 000	8 500 000	5 500 000	39.3
Malaysia	*	*	2 500 000	2 430 000	2 500 000	2 800 000	2 800 000	3 000 000	2 800 000	3 325 000	3 000 000	3 000 000	3 100 000	+ 600 000	+ 24.0
Others	456 040	413 700	121 230	456 140	699 270	527 200	425 200	480 500	541 800	602 600	408 400	549 000	591 300	+ 470 070	+ 387.8
Total Asia-Pacific	**15.635.040**	**21.047.700**	**21.234.230**	**19.391.140**	**19.479.270**	**20.007.200**	**19.355.200**	**19.630.500**	**19.150.800**	**19.756.077**	**18.969.400**	**18.529.900**	**18.856.300**	**− 2.377.930**	**− 11.2**
Norway	4 000 000	7 300 000	7 000 000	5 660 000	6 000 000	5 900 000	5 750 000	5 500 000	7 620 000	6 800 000	7 660 000	8 300 000	10 900 000	+ 3 900 000	+ 55.7
United Kingdom	10 000 000	15 700 000	16 000 000	16 800 000	19 000 000	16 000 000	15 400 000	14 800 000	14 800 000	13 900 000	13 150 000	13 590 000	13 000 000	3 000 000	18.8
Others	1 990 500	2 814 000	2 487 700	2 078 810	1 862 500	2 066 000	2 626 400	2 785 000	2 214 500	2 223 680	2 209 480	2 535 500	2 512 600	+ 24 900	+ 1.0
Total Western Europe	**15.990.500**	**25.814.000**	**25.487.700**	**24.538.810**	**26.862.500**	**23.966.000**	**23.776.400**	**23.085.000**	**24.634.500**	**22.923.680**	**23.019.480**	**24.425.500**	**26.412.600**	**+ 924.900**	**+ 3.6**
Abu Dhabi	21 500 000	30 000 000	29 500 000	29 000 000	31 000 000	30 000 000	28 000 000	29 000 000	30 600 000	30 510 000	30 400 000	30 500 000	31 000 000	+ 1 500 000	+ 5.1
Divided Zone	17 500 000	17 300 000	6 400 000	6 300 000	6 200 000	6 480 000	6 260 000	6 060 000	6 500 000	5 840 000	5 695 000	5 420 000	5 380 000	1 020 000	15.9
Dubai	2 500 000	2 420 000	1 350 000	1 500 000	1 400 000	1 300 000	1 400 000	1 400 000	1 270 000	1 440 000	1 440 000	1 440 000	1 400 000	+ 50 000	+ 3.7
Iran	60 000 000	66 000 000	64 500 000	63 000 000	62 000 000	59 000 000	58 000 000	57 500 000	57 000 000	55 308 000	51 000 000	48 500 000	47 876 000	16 624 000	25.8
Iraq	31 500 000	35 000 000	34 300 000	34 000 000	34 500 000	32 100 000	31 000 000	30 000 000	29 700 000	41 000 000	43 000 000	44 500 000	44 110 000	+ 9 810 000	+ 28.6
Kuwait	64 000 000	72 800 000	68 000 000	67 400 000	67 000 000	66 200 000	65 400 000	64 900 000	64 480 000	64 230 000	63 900 000	90 000 000	89 774 000	+ 21 774 000	+ 32.0
Oman	5 250 000	6 000 000	5 900 000	5 800 000	5 650 000	2 500 000	2 400 000	2 340 000	2 570 000	2 730 000	2 790 000	3 500 000	4 000 000	1 900 000	32.2
Qatar	6 500 000	6 000 000	5 850 000	5 700 000	5 600 000	4 000 000	3 760 000	3 585 000	3 434 000	3 425 000	3 330 000	3 350 000	3 300 000	− 2 550 000	43.6
Saudi Arabia	132 000 000	164 500 000	148 600 000	151 400 000	150 000 000	165 700 000	163 350 000	165 000 000	164 600 000	162 400 000	166 000 000	169 000 000	168 800 000	+ 20 200 000	+ 13.6
Syria	7 100 000	1 500 000	2 240 000	2 200 000	2 150 000	2 080 000	2 000 000	1 940 000	1 890 000	1 521 000	1 490 000	1 450 000	1 440 000	800 000	35.7
Others	2 312 500	2 338 200	1 770 570	1 380 000	666 000	636 000	377 300	346 000	795 950	881 893	1 055 800	720 750	945 710	824 860	46.6
Total Middle East	**350.162.500**	**403.858.200**	**368.410.570**	**367.680.000**	**366.166.000**	**369.996.000**	**361.947.300**	**362.071.000**	**362.839.950**	**369.285.893**	**370.100.800**	**398.380.750**	**398.025.710**	**+ 29.615.140**	**+ 8.0**
Algeria	7 640 000	7 700 000	7 370 000	6 800 000	6 600 000	6 300 000	8 440 000	8 200 000	8 080 000	9 440 000	9 220 000	9 000 000	8 820 000	+ 1 450 000	+ 19.7
Angola-Cabinda	1 500 000	1 175 000	1 300 000	1 210 000	1 160 000	1 115 000	1 200 000	1 200 000	1 450 000	1 635 000	1 700 000	1 800 000	2 000 000	+ 700 000	+ 53.8
Congo Republic	4 888 000	4 874 000	2 450 000	285 000	360 000	315 000	400 000	660 000	1 300 000	1 550 000	400 000	480 000	650 000	− 1 800 000	− 73.5
Egypt	5 125 000†	3 700 000	3 900 000	1 950 000	2 450 000	3 200 000	3 100 000	2 900 000	2 930 000	3 325 000	3 450 000	3 200 000	3 850 000	50 000	1.3
Libya	25 500 000	26 600 000	26 100 000	25 500 000	25 000 000	24 300 000	23 500 000	23 000 000	22 600 000	21 500 000	21 270 000	21 100 000	21 300 000	4 800 000	− 18.4
Nigeria	20 000 000	20 900 000	20 200 000	19 500 000	18 700 000	18 200 000	17 400 000	16 700 000	16 500 000	16 750 000	16 550 000	16 650 000	16 600 000	3 600 000	− 17.8
Tunisia	950 000	1 100 000	1 065 000	2 700 000	2 670 000	2 300 000	2 250 000	1 652 000	1 690 000	1 860 000	1 820 000	1 514 000	1 800 000	+ 735 000	+ 69.0
Others	1 700 750	2 250 450	2 700 220	2 625 200	2 260 150	2 162 125	782 100	836 375	1 621 630	1 761 690	2 497 020	1 796 550	1 714 050	986 170	36.5
Total Africa	**67.303.750**	**68.299.450**	**65.085.220**	**60.570.200**	**59.200.150**	**57.892.125**	**57.072.100**	**55.148.375**	**56.171.630**	**57.821.690**	**56.907.020**	**55.540.550**	**56.734.050**	**− 8.351.170**	**− 12.8**
Argentina	2 500 000	2 346 000	2 465 000	2 300 000	2 503 000	2 400 000	2 400 000	2 457 000	2 650 000	2 590 000	2 428 700	2 266 000	2 300 000	165 000	6.7
Brazil	799 000	775 000	780 000	800 000	880 000	1 200 000	1 220 000	1 300 000	1 325 060	1 750 000	1 800 000	1 976 000	2 070 000	+ 1 290 000	+ 165.4
Ecuador	5 675 000	2 500 000	2 450 000	1 700 000	1 640 000	1 170 000	1 100 000	1 100 000	850 000	1 400 000	1 675 000	1 400 000	1 650 000	800 000	32.7
Mexico	3 600 000	13 582 000	9 500 000	7 000 000	14 000 000	16 000 000	31 250 000	44 000 000	56 990 000	48 300 000	48 000 000	48 600 000	49 300 000	+ 39 800 000	+ 418.9
Venezuela	14 000 000	15 000 000	17 700 000	15 270 000	18 200 000	18 000 000	17 870 000	17 950 000	20 300 000	21 500 000	24 850 000	25 845 000	25 591 000	+ 7 891 000	+ 44.6
United States	34 700 249	35 299 839	33 000 000	31 300 000	29 500 000	28 500 000	26 500 000	26 400 000	29 785 000	29 785 000	27 300 000	27 300 000	6 500 000	26 500 000	80.3
Canada	9 424 170	9 400 000	7 100 000	6 200 000	6 000 000	6 000 000	6 800 000	6 400 000	7 300 000	7 020 000	6 730 000	7 075 000	28 000 000	+ 20 900 000	+ 294.4
Others	5 066 250	6 375 000	2 473 000	2 538 950	3 147 000	2 476 500	2 632 500	2 682 837	2 867 210	2 942 066	2 922 200	3 228 700	3 331 400	+ 858 400	+ 34.7
Total Western Hemisphere	**75.764.669**	**85.277.839**	**75.468.000**	**67.108.950**	**75.870.000**	**75.746.500**	**89.772.500**	**102.289.837**	**122.067.270**	**115.287.066**	**115.705.900**	**117.690.700**	**118.742.400**	**+ 43.274.400**	**+ 57.3**
Total Non-Communist	**524.856.459**	**604.297.189**	**555.685.720**	**539.290.000**	**547.847.920**	**547.607.825**	**551.623.500**	**562.224.712**	**584.864.150**	**585.074.406**	**584.702.600**	**614.567.400**	**618.771.060**	**+ 63.085.340**	**+ 11.4**
China	20 000 000	25 000 000	20 000 000	20 000 000	20 000 000	20 000 000	20 000 000	20 500 000	19 895 000	19 485 000	19 100 000	19 100 000	18 420 000	1 580 000	7.9
U.S.S.R.	80 000 000	83 400 000	80 400 000	78 100 000	75 000 000	71 000 000	67 000 000	63 000 000	63 000 000	63 000 000	63 000 000	63 000 000	61 000 000	19 400 000	24.1
Others	3 000 000	3 000 000	3 000 000	3 000 000	3 000 000	3 000 000	3 000 000	2 800 000	2 950 000	2 630 000	2 500 000	2 000 000	1 950 000	1 050 000	35.0
Total Communist	**103.000.000**	**111.400.000**	**103.400.000**	**101.100.000**	**98.000.000**	**94.000.000**	**90.000.000**	**86.300.000**	**85.845.000**	**85.115.000**	**84.600.000**	**84.100.000**	**81.370.000**	**− 22.030.000**	**− 21.3**
Total World	**627.856.459**	**715.697.189**	**659.085.720**	**640.390.000**	**645.847.920**	**641.607.825**	**641.623.500**	**648.524.712**	**670.709.150**	**670.189.406**	**669.302.600**	**698.667.400**	**700.141.060**	**+ 41.055.340**	**+ 6.2**
Total OPEC	**421.815.000**	**485.306.000**	**450.182.000**	**440.685.000**	**440.185.000**	**445.186.000**	**435.831.300**	**434.580.000**	**436.709.000**	**436.858.000**	**448.420.000**	**476.415.000**	**475.211.000**	**+ 25.029.000**	**+ 5.6**
OPEC as % of world	67.2%	67.8%	68.3%	68.9%	68.2%	69.4%	68.0%	67.1%	65.2%	65.2%	67.0%	68.2%	67.9%	—	—

*Included in Brunei. †Government figure. Later revised significantly downward.

Source: Oil & Gas Journal.

for fueling economic growth. Although the costs of other energy forms were also on the rise, costs were not increasing as rapidly. Oil led the way and became the highest-cost energy form for many activities.

Non-communist production, which is more sensitive to market forces, fell 9.74 million b/d (19%) to 41.54 million b/d. Communist area production actually continued to rise over this period, increasing from 14.495 million b/d in 1979 to 15.145 million b/d in 1983.

There was a slight rebound in production, both total world and non-communist, in 1984. Non-communist production increased 1.33 million b/d (3.2%) to 42.87 million b/d. Total world output increased 1.42 million b/d, up 2.5%, to 58.105 million b/d. Lower crude oil prices and increased economic growth were the major reasons for this increase in production.

Crude oil prices peaked in early 1981 and slid downward gradually throughout the 1981–1985 period. And then prices fell sharply in early 1986.

The initial drop in prices was mainly due to the development of a massive excess crude oil capacity worldwide. Both increased output in non-OPEC countries and the drop in demand contributed to the excess capacity. In fact, the real key to understanding the world oil supply situation and crude oil price developments is understanding the worldwide crude production capacity situation.

Over time, as more and more oil was required to fuel worldwide economic growth, production capacity was expanded to meet the demand. Production facilities were installed to allow a buffer for maintenance and other-non-routine contingencies. Generally, output was planned to average about 92% of installed capacity. The international oil companies, as a rule, obtained concessions and developed the lower-cost areas first. These were the prolific fields of the OPEC countries. Capacity seldom exceeded demand because the rate of installation of new capacity was regulated to meet demand growth.

OPEC production reached 65.6% of non-communist demand by 1976.

As demand for oil increased throughout the 1960's and into the 1970's, it was increasing production from the OPEC countries that filled the need. By 1976, OPEC output represented 51.8% of total worldwide output, and 65.6% of non-communist world demand. OPEC production actually peaked in 1977 at 31.68 million b/d, 50.6% of worldwide production, and 64.5% of non-communist production. OPEC output remained above 30 million b/d in 1978 and 1979, with 1979 at 31.47 million b/d. This was 47.8% of total world demand and 61.4% of non-communist demand.

OPEC was beginning to lose a part of its market share because the rapid rise in prices had stimulated the development of crude production in non-OPEC countries, and non-OPEC output was beginning to supply a greater proportion of demand.

The development of the present-day excess-capacity situation actually started earlier. In the late 1960's and early 1970's, as worldwide demand was on the rise, the OPEC countries gained control of their oil resources from the international oil companies. The international oil companies had been efficient at exploration and production. The price was kept low by continuous development of additional oil resources in the face of rising demand. When OPEC gained control, they took advantage of the dependence on oil and the worldwide expansion that was being fueled by oil. They chose to test the demand response to higher prices (elasticity of demand), and raised prices sharply in 1973-1974. Demand continued to rise, so

WORLDWIDE OIL PRODUCTION*

Country/Area	1975	1976	1977	1978	1979	1980 (1,000 b/d)	1981	1982	1983	1984	1985	% change 85/75	% change 85/79
NORTH AMERICA													
U.S.	10,010	9,735	9,865	10,275	10,135	10,170	10,180	10,200	10,245	10,505	10,540	5.3	4.0
Canada	1,735	1,605	1,610	1,575	1,770	1,725	1,545	1,485	1,515	1,645	1,645	-5.2	-7.1
Total North America	**11,745**	**11,340**	**11,475**	**11,850**	**11,905**	**11,895**	**11,725**	**11,685**	**11,760**	**12,150**	**12,185**	**3.7**	**2.4**
LATIN AMERICA													
Argentina	390	390	430	455	470	490	490	490	475	465	445	14.1	-5.3
Brazil	170	170	165	165	170	195	220	275	365	460	545	220.6	220.6
Colombia	160	145	140	130	150	125	135	145	155	170	175	9.4	16.7
Ecuador	160	185	190	205	215	205	210	200	240	255	280	75.0	30.2
Mexico	790	875	1,085	1,330	1,630	2,155	2,585	3,005	2,950	3,015	3,015	281.6	85.0
Trinidad	215	215	230	230	215	210	200	175	165	170	180	-16.3	-16.3
Venezuela	2,425	2,375	2,315	2,235	2,425	2,235	2,180	1,965	1,875	1,875	1,745	-28.0	-28.0
Others	150	150	160	215	255	280	275	295	260	270	270	80.0	5.9
Total Latin America	**4,460**	**4,505**	**4,715**	**4,965**	**5,530**	**5,895**	**6,295**	**6,550**	**6,485**	**6,680**	**6,655**	**49.2**	**20.3**
WESTERN EUROPE													
Austria	40	40	35	35	35	30	25	25	25	25	25	-37.5	-28.6
Denmark	5	5	10	10	10	5	15	35	45	45	60	1,100.0	500.0
France	20	20	20	20	25	30	35	50	50	60	70	250.0	180.0
Italy	20	20	20	25	30	35	25	30	40	40	40	100.0	33.3
Norway	190	280	275	350	385	525	505	530	660	755	840	342.1	118.2
Turkey	60	50	55	55	55	45	45	45	45	40	40	-33.3	-27.3
United Kingdom	30	240	765	1,095	1,600	1,650	1,835	2,125	2,360	2,580	2,640	8,700.0	65.0
West Germany	115	110	105	100	95	90	90	85	80	80	80	-30.4	-15.8
Others	65	65	45	45	60	65	60	95	145	140	145	123.1	141.7
Total Western Europe	**545**	**830**	**1,330**	**1,735**	**2,295**	**2,475**	**2,635**	**3,020**	**3,450**	**3,765**	**3,940**	**622.9**	**71.7**
MIDDLE EAST													
Abu Dhabi	1,400	1,595	1,665	1,450	1,465	1,345	1,135	885	830	825	890	-36.4	-39.2
Dubai	255	315	320	360	355	350	360	360	345	375	390	52.9	9.9
Iran	5,385	5,920	5,705	5,275	3,175	1,480	1,325	2,410	2,465	2,195	2,225	-58.7	-29.9
Iraq	2,260	2,415	2,350	2,560	3,475	2,645	895	1,010	1,105	1,225	1,435	-36.5	-58.7
Kuwait	1,885	1,965	1,835	1,945	2,270	1,430	965	705	900	985	910	-51.7	-59.9
Neutral Zone	500	465	390	470	570	545	375	315	310	405	360	-28.0	-36.8
Oman	340	365	340	315	295	285	325	325	390	420	505	48.5	71.2
Qatar	435	495	445	485	510	460	425	340	310	425	310	-28.7	-39.2
Saudi Arabia	6,970	8,525	9,235	8,315	9,555	9,990	9,985	6,695	5,225	4,760	3,600	-48.4	-62.3
Others	285	290	260	250	240	225	225	230	230	240	245	-14.0	2.1
Total Middle East	**19,715**	**22,350**	**22,545**	**21,425**	**21,910**	**18,755**	**16,015**	**13,275**	**12,110**	**11,855**	**10,870**	**-44.9**	**-50.4**
AFRICA													
Algeria	1,020	1,075	1,150	1,230	1,255	1,120	1,035	1,045	980	1,075	1,040	2.0	-17.1
Egypt	295	325	415	480	525	590	690	705	725	860	880	198.3	67.6
Libya	1,480	1,930	2,065	1,985	2,090	1,830	1,220	1,135	1,110	1,105	1,090	-26.4	-47.8
Other North Africa	95	75	100	100	115	120	115	105	115	120	115	21.1	—
Gabon	225	225	220	210	205	175	150	155	155	150	155	-31.1	-24.4
Nigeria	1,785	2,065	2,085	1,895	2,300	2,055	1,440	1,285	1,235	1,385	1,475	-17.4	-35.9
Other West Africa	205	165	230	195	260	285	330	355	420	510	530	158.5	103.8
Total Africa	**5,105**	**5,860**	**6,265**	**6,095**	**6,750**	**6,175**	**4,980**	**4,785**	**4,740**	**5,205**	**5,285**	**3.5**	**-21.7**
ASIA AND AUSTRALASIA													
Japan	10	10	10	10	10	10	10	10	10	10	10	—	—
Brunei	190	205	220	205	240	235	175	165	175	160	150	21.1	-37.5
Indonesia	1,305	1,505	1,690	1,635	1,590	1,575	1,680	1,415	1,345	1,410	1,310	0.4	-17.6
Malaysia	100	165	185	215	285	275	250	295	420	440	425	325.0	49.1
Other Southeast Asia	5	5	10	5	10	15	10	15	25	35	70	1,300.0	600.0
South Asia	195	200	240	260	300	230	340	440	550	610	665	241.0	121.7
Australasia†	415	430	450	450	455	400	410	420	470	550	650	56.6	42.9
Total Asia and Australasia	**2,220**	**2,520**	**2,809**	**2,780**	**2,890**	**2,740**	**2,875**	**2,760**	**2,995**	**3,215**	**3,280**	**47.7**	**13.5**
Total Non-Communist World	**43,790**	**47,405**	**49,135**	**48,850**	**51,280**	**47,935**	**44,525**	**42,075**	**41,540**	**42,870**	**42,215**	**- 3.6**	**-17.7**
COMMUNIST													
China	1,490	1,675	1,880	2,090	2,130	2,125	2,035	2,050	2,135	2,300	2,510	68.5	17.8
U.S.S.R.	9,935	10,520	11,055	11,595	11,870	12,215	12,370	12,430	12,520	12,450	12,140	22.2	2.3
Others	485	480	490	515	495	470	445	505	490	485	475	-2.1	-4.0
Total Communist	**11,910**	**12,675**	**13,425**	**14,200**	**14,495**	**14,810**	**14,850**	**14,985**	**15,145**	**15,235**	**15,125**	**27.0**	**4.3**
Total World	**55,700**	**60,080**	**62,560**	**63,050**	**65,775**	**62,745**	**59,375**	**57,060**	**56,685**	**58,105**	**57,340**	**2.9**	**-12.8**
OPEC	27,535	31,100	31,680	30,280	31,465	27,445	23,380	19,930	18,425	18,470	17,225	-37.4	-45.3

*Includes natural gas liquids

†Includes Australia and New Zealand

Source: British Petroleum

they boosted prices again in 1979-1981.

These price hikes had a dramatic impact on the production capacity situation worldwide, but particularly in the OPEC countries.

Through the 1960's and up until 1973, excess capacity in the worldwide oil industry was 7–8%. Excess capacity was 7% of total capacity and 8% of production. After the price hike, excess capacity began to increase, moving up to 10-12% in 1974 and as high as 19-25% in 1975. This was 19% of available capacity and 25% of production. The Iranian revolution helped drop excess capacity to the 9-10% level and allowed OPEC to push through the massive 1979–1980 price increase.

But, following 1979, the combination of declining demand and rising non-OPEC production has resulted in massive excess capacity. Most OPEC capacity had been put in place by 1977, but non-OPEC production had been stimulated by the increase in prices, and new capacity has been added continuously. Only the Iranian revolution and the Iran-Iraq war have kept the excess capacity situation in check. But by 1983 excess capacity was 15.6 million b/d, which was 29% of total capacity and 41% of total production/demand.

Excess capacity dropped only marginally in 1984 to 15.3 million b/d. This was still 28% of total available non-communist capacity and 39% of total production. This excludes about 7 million b/d shut in due to the Iran-Iraq war. It is difficult to determine how much of that 7 million b/d is still available, but a substantial proportion could probably be brought back on stream if required.

Excess production capacity was equal to 41% of 1985 production.

In 1985, excess capacity moved up again to 15.9 million b/d. This represented 29% of total non-communist oil production capacity, and about 41% of total oil production. This massive excess production capacity has been putting downward pressure on prices since 1981. It has been the major reason for the steady decline in prices since early 1981.

OPEC adopted a very aggressive pricing policy when demand and capacity were in line. Because of that policy, when demand began to fall, it was at the expense of OPEC output. As stated, OPEC production peaked in 1977 at 31.7 million b/d. This was 64.5% of free-world production. In 1982, for the first time in its history, OPEC production fell below 50% of free-world production. In that year, OPEC output was 19.93 million b/d, 47.4% of free-world output.

By 1984, OPEC production had fallen to 18.5 million b/d, a drop of 41.7%. This was only 43% of total free-world production. And in 1985, OPEC production fell another 7.2% to 17.225 million b/d. This was only 40.8% of non-communist output; and 30% of total world production. OPEC output had fallen 45.6% from the 1977 peak, a drop of 14.455 million b/d.

Non-OPEC production increased 53.7% from 1975 to 1985.

In response to the higher prices, non-OPEC production has been increasing steadily since 1975. This is a classical economics supply response to markedly higher prices.

Non-OPEC non-communist production has increased 53.7%, from 16.255 million b/d in 1975 to 24.99 million b/d in 1985. Obviously, the OPEC-led increase in prices has made oil production economical in a number of other areas of the world. The increases in non-OPEC production have occurred throughout the world. Major increases have been recorded in Brazil and Mexico in the western hemisphere. Norway and the United Kingdom have boosted production substantially in Western Europe. Elsewhere, there have been large increases in Egypt and India. A number of these countries have become major exporters of crude oil and are in direct competition with the OPEC

WORLDWIDE NATURAL GAS PRODUCTION

(Billion cu ft)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	% change 85/75
NORTH AMERICA												
U.S.	19,235	19,098	19,165	19,122	19,663	19,404	19,181	17,758	16,033	17,393	16,554	-13.9
Canada	2,701	2,717	2,850	2,744	2,944	2,709	2,642	2,606	2,454	2,427	2,623	-2.9
Total North America	**21,936**	**21,815**	**22,015**	**21,866**	**22,607**	**22,113**	**21,823**	**20,364**	**18,487**	**19,820**	**19,177**	**-12.6**
LATIN AMERICA												
Argentina	270	259	267	274	255	278	294	341	365	357	365	35.2
Bolivia	59	63	63	67	78	82	98	102	98	98	98	66.1
Chile	122	141	133	125	122	98	82	110	106	102	102	-16.4
Mexico	584	576	725	862	917	1,066	1,227	1,282	1,231	1,149	1,098	88.0
Trinidad	63	78	59	74	114	86	86	86	106	122	114	81.0
Venezuela	451	478	525	521	576	588	588	600	553	612	612	35.7
Others	125	130	145	159	165	170	185	188	234	265	273	118.4
Total Latin America	**1,674**	**1,725**	**1,917**	**2,082**	**2,227**	**2,368**	**2,560**	**2,709**	**2,693**	**2,705**	**2,662**	**59.0**
WESTERN EUROPE												
France	270	259	278	286	282	274	259	243	216	208	176	-34.8
Italy	514	612	455	486	474	404	455	498	435	459	459	-10.7
Netherlands	2,693	2,885	2,873	2,530	2,775	2,701	2,650	2,285	2,395	2,411	2,575	-4.4
Norway	8	12	102	525	760	925	921	898	898	972	941	11,662.5
United Kingdom	1,250	1,321	1,380	1,321	1,341	1,254	1,250	1,196	1,200	1,305	1,388	11.0
West Germany	537	553	564	604	604	553	564	494	514	537	498	-7.3
Others	91	81	87	87	87	71	51	46	46	66	94	3.3
Total Western Europe	**5,363**	**5,723**	**5,739**	**5,939**	**6,323**	**6,182**	**6,150**	**5,660**	**5,704**	**5,958**	**6,131**	**14.3**
MIDDLE EAST												
Abu Dhabi	39	47	114	176	220	204	212	216	220	227	231	492.3
Iran	772	760	741	686	706	294	255	255	388	478	478	-38.1
Kuwait	184	196	212	220	306	243	188	145	169	172	176	-4.3
Saudi Arabia	200	239	282	333	412	517	898	372	329	459	478	139.0
Others	244	236	243	247	379	388	[illegible]	364	325	408	428	75.4
Total Middle East	**1,439**	**1,478**	**1,592**	**1,662**	**2,023**	**1,646**	**1,882**	**1,352**	**1,431**	**1,744**	[illegible]	**24.5**
AFRICA												
Algeria	337	349	306	490	917	757	866	941	1,258	1,192	1,243	268.8
Libya	122	133	137	180	239	184	141	141	118	133	157	28.7
Nigeria	16	24	20	12	47	39	63	43	51	59	51	218.8
Others	24	31	39	47	63	71	71	110	125	164	199	729.2
Total Africa	**498**	**537**	**502**	**729**	**1,266**	**1,051**	**1,141**	**1,235**	**1,552**	**1,548**	**1,650**	**231.3**
ASIA AND AUSTRALASIA												
Japan	86	86	98	94	86	78	74	71	74	74	78	-9.3
Indonesia	82	82	200	384	557	655	678	694	780	1,168	1,152	1,304.9
Other Southeast Asia	290	388	404	392	392	419	427	416	447	486	478	64.8
Pakistan	165	184	208	208	200	243	239	310	337	357	388	135.2
Other South Asia	180	182	204	204	196	220	260	359	404	545	561	211.7
Australasia*	216	274	329	349	384	427	466	494	533	545	604	179.6
Total Asia and Australasia	**1,019**	**1,196**	**1,443**	**1,631**	**1,815**	**2,042**	**2,144**	**2,344**	**2,575**	**3,175**	**3,261**	**220.0**
Total Non-Communist World	**31,929**	**32,474**	**33,208**	**33,909**	**36,261**	**35,402**	**35,700**	**33,664**	**32,442**	**34,950**	**34,672**	**8.6**
COMMUNIST												
China	349	392	423	486	490	478	455	392	423	427	451	29.2
USSR	10,208	11,337	12,219	12,713	13,861	14,904	16,143	17,691	18,910	20,713	22,681	122.2
Others	1,913	2,116	2,093	2,148	2,042	2,007	2,100	2,113	2,184	2,313	2,379	24.4
Total Communist	**12,470**	**13,845**	**14,735**	**15,347**	**16,393**	**17,389**	**16,598**	**20,196**	**21,517**	**23,453**	**25,511**	**104.6**
Total World	**44,399**	**46,319**	**47,943**	**49,256**	**52,[illegible]**	**52,791**	**54,398**	**53,860**	**53,959**	**58,403**	**60,183**	**35.6**

*Includes Australia and New Zealand

Source: British Petroleum

WORLD CRUDE OIL PRICES

Official Sales and Term Contracts
(Dollars per barrel)
(1 January)

Year	Total World	Total OPEC	Total Non-OPEC	Difference Non-OPEC-OPEC
1975-1978 — Not Available				
1979	13.08	13.03	13.44	+0.41
1980	28.84	28.30	31.94	+3.64
1981	35.49	34.82	38.54	+3.72
1982	34.18	34.13	34.35	+0.22
1983	33.00	33.54	31.72	-1.82
1984	28.61	28.59	28.65	+0.06
1985	28.33	28.43	28.16	-0.27
1986	27.10	27.81	26.14	-1.67
June 1986	12.00	12.16	11.77	-0.39
CHANGE 1981 to 1986				
Actual	-8.39	-7.01	-12.40	
Percentage	-23.6%	-20.1%	-32.2%	
CHANGE 1 Jan. 1986 to June 1986				
Actual	-15.10	-15.65	-14.37	
Percentage	-55.7%	-56.3%	-55.0%	

Source: Energy Information Administration

PRICE–ARABIAN LIGHT CRUDE

— (U.S. dollars per barrel) —

Year	Average government selling price*	Average spot market price	Difference
1975	10.46	10.70	+ 0.24
1976	11.51	11.63	+ 0.12
1977	12.09	12.43	+ 0.34
1978	12.70	13.00	+ 0.30
1979	13.34	29.89	+ 16.55
1980	26.00	35.69	+ 9.69
1981	32.00	34.30	+ 2.30
1982	34.00	31.76	2.24
1983	34.00	28.80	5.20
1984	29.00	27.80	1.20
1985	29.00	26.60	2.40
1986-June	12.70		

Note: Government selling price—moved up $23.54 per barrel (225.0%) from 1975 to peak in 1982. Spot market price—moved up $24.99 per barrel (233.6%) from 1975 to peak in 1980. Fell $9.09 per barrel (25.5%) from peak by end 1985.

*As of January 1

Source: DOE and Shell Oil

OECD* PETROLEUM STOCKS

	Million barrels								1981/1978		1985/1981	
	1978	1979	1980	1981	1982	1983	1984	1985	Change	% change	Change	% change
Canada	144	150	164	161	136	120	127	111	+ 17	+ 11.8	- 50	- 31.1
France	201	226	243	214	193	153	153	138	+ 13	+ 6.5	- 76	- 35.5
Italy	154	163	170	167	179	149	159	157	+ 13	+ 8.4	- 10	- 6.0
Japan	413	460	495	482	484	471	480	495	+ 69	+ 16.7	+ 13	+ 2.7
United Kingdom	157	169	168	143	125	119	113	123	- 14	- 8.9	- 20	- 14.0
United States	1,278	1,341	1,392	1,484	1,430	1,454	1,556	1,516	+ 206	+ 16.1	+ 32	+ 2.2
West Germany	238	272	319	297	272	250	240	233	+ 59	+ 24.8	- 64	- 21.5
Other OECD	537	598	636	583	557	542	536	509	+ 46	+ 8.6	- 74	- 12.7
Total OECD	**3,122**	**3,379**	**3,587**	**3,531**	**3,376**	**3,258**	**3,364**	**3,282**	**+409**	**+13.1**	**-249**	**- 7.1**

*Organization of Economic Cooperation & Development
Source: Energy Information Administration

exporters.

In addition to increasing non-OPEC non-communist production, the U.S.S.R. has been increasing production and exports. This has added to the crude glut and increased the impact on OPEC. U.S.S.R. output moved up 27.9% between 1975 and 1984. They are the world's largest producer. Their production fell 1.1% in 1985 to 15.125 million b/d, and there is some question how long this level of production can be sustained. However, they have a program to replace internal oil consumption with gas and maintain exports. This would continue to add an element to the excess-capacity situation in the market-oriented world.

It is this massive excess capacity, which developed in the OPEC countries, that has put a constant downward pressure on crude oil prices.

OPEC has tried to stabilize prices by establishing production quotas for individual countries and the group as a whole. However, few of the countries, other than Saudi Arabia, have exhibited the production discipline necessary to make the quotas work. But the willingness of Saudi Arabia and a few other OPEC members to show some restraint managed to prevent a much-earlier free fall in prices. But it was impossible to stabilize prices, and they continued to slide downward from 1981 through 1985.

OPEC becomes the swing producers with the highest price oil.

OPEC production, particularly in the Persian Gulf area, is some of the lowest cost in the world. But the aggressive pricing policies of OPEC have resulted in OPEC oil being the highest priced in the world. The result has been that, wherever possible, OPEC oil supplies have been replaced by domestic crude or other, less costly, imported crude.

Therefore, OPEC has become the swing producer meeting the gap between demand and non-OPEC production. Therefore, all excess capacity, except for some minor exceptions, has been thrust upon OPEC. About 47% of installed OPEC capacity, 14 million b/d out of 30 million b/d was shut in during 1985.

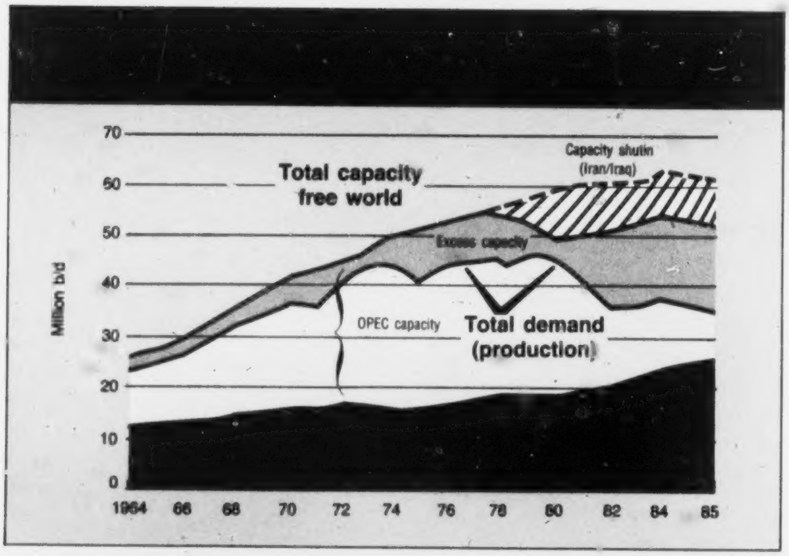
The OPEC cartel pricing policies resulted in an oil industry turned upside down, with the cheapest production shut in and the most expensive production producing at full capacity.

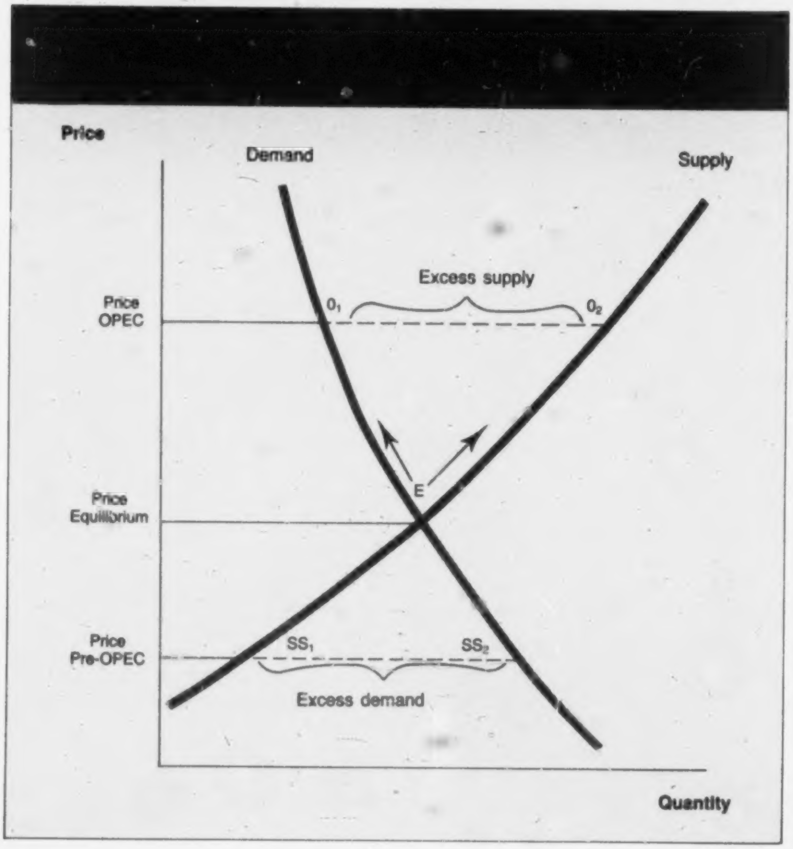
As stated in last year's outlook, "Only OPEC's ability to maintain production quotas will prevent the price from collapsing." OPEC wasn't able to establish group production discipline, Saudi Arabia abandoned the role of sole swing producer, and the result was a collapse in prices in the spring of 1986.

To get a better perspective on what has been happening in the world oil industry and world oil prices, it might be advantageous to take a look from the viewpoint of classical economic theory.

In classical theory, price is the determinant of supply and demand. When external forces create a situation where there is not equilibrium, i.e. demand and supply do not meet at a market clearing price, then there are economic forces at work attempting to move the market toward equilibrium.

Prior to the establishment of OPEC, there is some justification in assuming that the international oil companies held the price below the equilibrium price. This created a situation of excess demand. The oil companies met demand by concentrating on production, and pricing with respect to current production costs. Little emphasis was given to the long-run value of reserves in the ground. The result was a rapid increase in demand as cheap oil energy fueled economic expansion worldwide.





THE STRAIT OF HORMUZ—1985

Country	Crude oil production 1,000 b/d
Iran	2,257
Kuwait	1,029
Bahrain	42
Saudi Arabia	3,455
Qatar	299
United Arab Emirates	1,142
Total	**8,224**
Free world production	38,542
% of free world production	21.3
Exports via Strait of Hormuz	
Crude	5,510
Products	1,090
Total	**6,600**
Free world crude imports	17,250
% of free world crude imports	31.9%
Free world crude & product imports	25,250
% of free world crude & product imports	26.1%

Source: Authors estimates

When OPEC gained control over production, they placed more emphasis on the long-term value and life of their oil reserves. They attempted to maximize immediate return rather than output. And they were searching for the price level the market would bear. To a certain extent, OPEC was using the world as a large economic laboratory to test the elasticity of demand for crude oil. The result of OPEC's pricing policy was reduced demand and increased supply, netting out to an excess-supply situation.

OPEC's pricing policy results in reduced demand, increased supply and excess capacity.

However, market forces began to take hold and movement started toward reestablishing equilibrium. This movement took the form of falling prices, increased demand and a reduction in the rate of increase in the non-OPEC crude supply. A brief review of what happened to prices over the past fifteen years will help clarify this classical description.

The official posted price of the OPEC market crude, Saudi Arabian light, was first boosted 294.2% from $2.75/bbl in 1973 to $10.84/bbl in 1974. The demand response was minimal, since oil was already underpriced. Then the price moved up slowly to $12.70/bbl in 1978, an additional increase of 17.2%. Because of the sharp increase in the rate of inflation over this period, the real price actually fell during this period. Demand for crude oil continued to move up even though the actual price had increased substantially. Demand is more responsive to the real price.

Since demand was still rising, OPEC decided to raise prices again. This time, they boosted prices sharply from $12.70/bbl in 1978 to $34.00/bbl at the end of 1981, an additional increase of 167.7%. The overall price increase from 1973 through 1981 was +31.25/bbl, up 1136.4%.

Demand reacted to this price increase. Conservation, fuel switching to other energy and a slow down in economic activity led to a 19% drop in production in the non-communist world between 1979 and 1983. This drop in demand for oil, coupled with the increase in non-OPEC production, resulted in the huge excess capacity in the OPEC countries.

This excess capacity put substantial downward pressure on prices. The official OPEC market crude price fell to $28/bbl in 1985, a reduction of 17.6% from the peak $34 level. The average spot market price fell from $35.69/bbl in 1980 to an estimated $27.80/bbl in 1984, a drop of 22.1%. Free-world demand responded to this sharp drop in prices, and moved up 2.1% in 1984.

Crude trading shifted to the spot market from 1981–1985.

The growth in excess capacity led to a shift in trading from contract to the spot market. When prices moved up sharply in 1979-1981, spot market prices were well above official prices. The average spot market price in 1979 was $12.60/bbl higher than the contract price. This undoubtedly prompted OPEC to push up the official price. With the development of the excess capacity, spot market prices fell below official prices and led to the drop in official prices.

The volume of crude traded in the spot market grew substantially from 1981 to 1985. By 1985, the vast majority of transactions were spot market transactions or contract trades based on spot market prices. In addition, because of the more speculative nature of crude trading and prices, a futures market has developed and is growing rapidly. In three years, the number of crude oil contracts traded on the New York Mercantile Exchange has taken off, with 350 million bbl in 1983, 1840 million bbl in 1984 and 3981 million bbl in 1985.

As stated earlier, in an attempt to prevent a collapse of prices, OPEC established production quotas for each member country.

WORLDWIDE OIL REFINING THROUGHPUTS

	1975	1976	1977	1978	1979	1980 (1,000 b/d)	1981	1982	1983	1984	1985	% change 85/75	% change 85/79
U.S.	12,475	13,435	14,625	14,780	14,465	13,520	12,470	11,775	11,685	12,045	12,025	-3.6	-16.9
Canada	1,700	1,710	1,805	1,820	1,960	2,085	1,945	1,650	1,545	1,570	1,450	-14.7	-26.0
Latin America	5,515	5,670	5,715	5,975	6,220	6,460	6,575	6,080	5,825	5,825	5,795	5.1	-6.8
Western Europe	12,415	13,625	13,550	13,505	14,160	12,925	11,890	11,480	11,270	11,505	11,240	-9.5	-20.6
Middle East	2,075	2,300	2,240	2,535	2,365	2,445	2,205	2,245	2,515	2,665	2,795	34.7	18.2
Africa	1,005	1,055	1,165	1,280	1,355	1,460	1,525	1,735	1,920	1,975	2,015	100.5	48.7
Japan	4,055	4,230	4,285	4,240	4,340	4,015	3,630	3,360	3,255	3,355	3,120	-23.1	-28.1
Southeast Asia	1,545	1,865	2,030	2,330	2,450	2,370	2,480	2,335	2,380	2,270	2,265	46.6	-7.6
South Asia	485	550	605	645	675	705	795	840	880	885	1,010	108.2	49.6
Australasia*	635	655	680	690	700	640	655	625	605	615	585	-7.9	-16.4
Total Non-Communist World	**41,905**	**45,095**	**46,700**	**47,800**	**48,690**	**46,625**	**44,170**	**42,125**	**41,880**	**42,710**	**42,300**	**0.9**	**-13.1**
Communist	11,025	11,575	11,930	12,875	13,230	13,320	13,420	13,575	13,675	13,885	14,165	28.5	7.1
Total World	**52,930**	**56,670**	**58,630**	**60,675**	**61,920**	**59,945**	**57,590**	**55,700**	**55,555**	**56,595**	**56,465**	**6.7**	**- 8.8**

*Includes Australia and New Zealand

Source: British Petroleum

WORLDWIDE OIL REFINING CAPACITIES

Country/Area	1975	1976	1977	1978	1979	1980 (1,000 b/d)	1981	1982	1983	1984	1985	% change 85/75	% change 85/81
NORTH AMERICA													
U.S.	15,235	16,400	16,945	17,375	17,920	18,250	18,290	16,860	15,865	15,660	15,180	-0.4	-17.0
Canada	2,080	2,195	2,220	2,340	2,315	2,150	2,155	2,260	2,025	2,015	2,065	-0.7	-4.2
Total North America	**17,315**	**18,595**	**19,165**	**19,715**	**20,235**	**20,400**	**20,445**	**19,120**	**17,890**	**17,675**	**17,245**	**-0.4**	**-15.7**
LATIN AMERICA													
Argentina	700	700	660	660	660	690	690	690	690	680	665	-5.0	-3.6
Brazil	1,020	1,020	1,175	1,230	1,230	1,375	1,530	1,530	1,400	1,305	1,305	27.9	-14.7
Mexico	785	970	975	990	1,340	1,475	1,525	1,620	1,630	1,680	1,680	114.0	10.2
Netherlands Antilles	810	810	840	840	840	840	780	780	780	740	320	-60.5	-59.0
Trinidad	460	460	465	465	465	455	455	375	375	320	260	-43.5	-42.9
Venezuela	1,445	1,445	1,445	1,445	1,445	1,425	1,405	1,360	1,225	1,225	1,230	-14.9	-12.5
Others	2,180	2,365	2,480	2,545	2,645	2,580	2,520	2,380	2,205	1,980	1,680	-22.9	-33.3
Total Latin America	**7,400**	**7,770**	**8,040**	**8,175**	**8,625**	**8,840**	**8,905**	**8,735**	**8,305**	**7,930**	**7,140**	**-3.5**	**-19.8**
WESTERN EUROPE													
Belgium	975	1,080	1,055	1,030	1,020	1,020	965	720	720	720	720	-26.2	-25.4
France	3,320	3,495	3,465	3,445	3,420	3,320	3,230	2,745	2,370	2,190	2,175	-34.5	-32.7
Italy	4,345	4,345	4,270	4,205	4,205	4,140	3,990	3,500	3,365	2,745	2,585	-40.5	-35.2
Netherlands	1,950	1,950	1,835	1,815	1,815	1,775	1,775	1,590	1,610	1,435	1,435	-26.4	-19.2
Spain	1,180	1,275	1,210	1,375	1,475	1,425	1,550	1,550	1,440	1,440	1,440	22.0	-7.1
United Kingdom	2,950	2,875	2,655	2,515	2,460	2,460	2,360	2,135	2,105	1,935	1,770	-40.0	-25.0
West Germany	3,115	3,110	3,065	3,090	3,040	3,095	2,955	2,520	2,280	2,115	1,750	-43.8	-40.8
Others	2,555	2,640	2,630	2,880	2,665	2,820	2,830	2,945	2,745	2,705	2,665	4.3	-5.8
Total Western Europe	**20,390**	**20,770**	**20,185**	**20,355**	**20,100**	**20,055**	**19,655**	**17,705**	**16,635**	**15,285**	**14,540**	**-28.7**	**-26.0**
MIDDLE EAST													
Bahrain	250	250	250	250	250	250	250	250	250	250	250	—	—
Iran	715	715	965	1,045	1,045	1,225	625	625	600	530	530	-25.9	-15.2
Iraq	185	185	185	230	265	265	265	265	200	300	300	62.2	13.2
Kuwait	565	575	575	575	575	575	530	545	590	590	550	-2.7	3.8
Saudi Arabia	465	630	630	635	635	495	660	865	865	865	1,115	139.8	68.9
Others	570	595	640	640	770	755	920	1,015	1,055	980	965	69.3	4.9
Total Middle East	**2,750**	**2,950**	**3,245**	**3,375**	**3,540**	**3,565**	**3,250**	**3,565**	**3,560**	**3,515**	**3,710**	**34.9**	**14.2**
Africa	1,270	1,380	1,505	1,730	2,000	2,060	2,035	2,355	2,340	2,540	2,545	100.4	25.1
ASIA AND AUSTRALASIA													
Japan	5,215	5,285	5,285	5,285	5,285	5,675	5,675	5,500	4,975	4,975	4,975	-4.6	-12.3
Indonesia	415	525	525	535	535	515	515	515	760	925	925	112.9	79.6
Singapore	1,040	1,040	1,040	1,040	1,040	1,020	1,020	1,020	1,020	1,020	1,020	-1.9	—
Other Southeast Asia	1,270	1,270	1,570	1,650	1,810	1,890	1,940	1,940	1,940	2,120	2,000	57.5	3.1
South Asia	735	735	785	825	825	870	885	995	1,020	995	1,150	56.5	29.9
Australasia*	760	760	760	785	800	810	815	815	815	785	705	-7.2	-13.5
Total Asia and Australasia	**9,435**	**9,615**	**9,965**	**10,120**	**10,295**	**10,780**	**10,850**	**10,785**	**10,530**	**10,820**	**10,775**	**14.2**	**-0.7**
Total Non-Communist World	**58,560**	**61,080**	**62,105**	**63,470**	**64,795**	**65,700**	**65,140**	**62,265**	**59,260**	**57,765**	**55,955**	**-4.4**	**-14.1**
COMMUNIST													
China	1,250	1,500	1,600	1,800	1,900	1,900	1,810	2,000	2,050	2,150	2,150	72.0	18.8
U.S.S.R.	9,060	9,400	9,600	10,000	10,500	10,700	11,600	11,750	12,000	12,000	12,000	32.5	3.4
Others	2,335	2,480	2,575	2,775	2,825	2,910	3,125	3,170	3,170	3,170	3,170	35.8	1.4
Total Communist	**12,645**	**13,380**	**13,775**	**14,575**	**15,225**	**15,510**	**16,535**	**16,920**	**17,220**	**17,320**	**17,320**	**37.0**	**4.7**
Total World	**71,205**	**74,460**	**75,860**	**78,045**	**80,020**	**81,210**	**81,675**	**79,185**	**76,480**	**75,085**	**73,275**	**2.9**	**-10.3**

*Includes Australia and New Zealand

Source: British Petroleum

OPEC set a production quota in 1983 of 17.5 million b/d. However, prices continued to slide and the production quota was reduced to 16 million b/d in 1984. There has been considerable cheating, with a number of OPEC countries producing above their quotas.

Saudi Arabian production fell to an unacceptably low level in 1985.

Saudi Arabia had been willing to play the role of swing producer and cut production sharply in order to support the worldwide price. Saudi production fell 6.39 million b/d, 64%, from 9.99 million b/d in 1980 to 3.6 million b/d in 1985. Other OPEC producers showed some restraint, and the result was a sufficient reduction in total production to prevent a free fall in prices.

But in the summer of 1985, Saudi production temporarily dipped below 2 million b/d in their role of swing producer. And it became apparent that with expected weak demand in 1986, their production would fall even further if they continued to be the supply source of last resort.

So in the fall of 1985 the Saudis unilaterally arranged, with several selected purchasers, to sell their oil using a new net-back pricing arrangement. They were willing to accept a lower price for their oil based on the net-back value after product sales and refining in order to increase their market share. In a subsequent meeting, OPEC policy was changed to one aimed at regaining market share rather than supporting prices. This shift in OPEC policy in effect brought the full weight of the excess crude capacity to bear on worldwide crude oil prices. The result was a collapse in the price of crude oil in early 1986, when winter demand began to slacken.

The average price of world export crude fell from $27.10/bbl at end 1985 to $9.80/bbl at end June, 1986, a drop of 64%. This collapse in prices has had a severe impact on the revenues of all the major oil exporting countries.

The new OPEC policy aimed at stimulating demand.

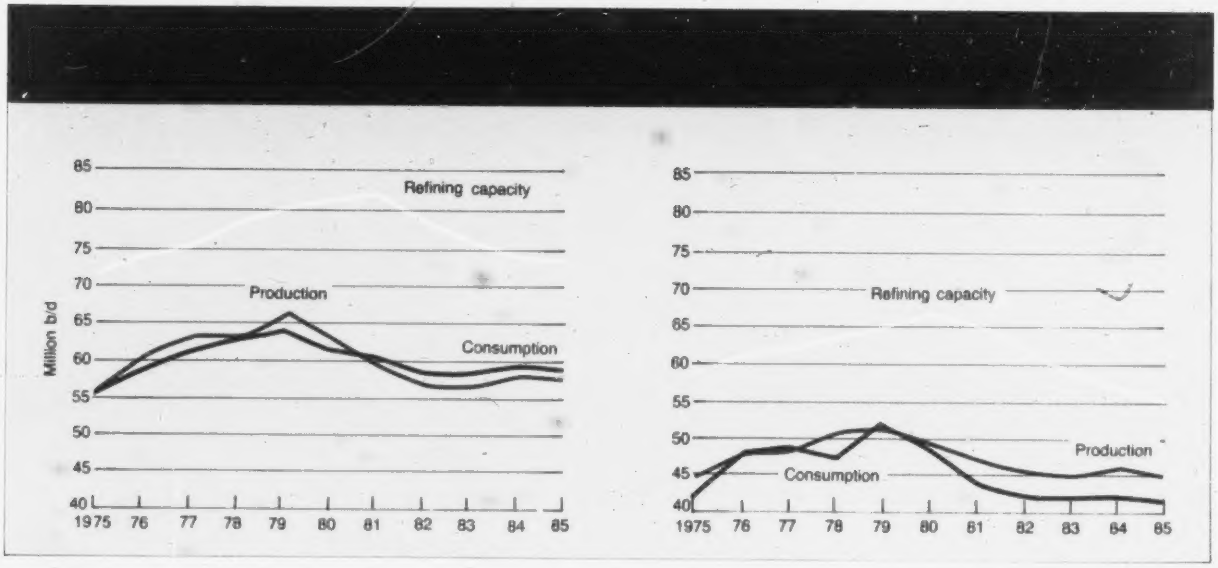
Although the price drop may be greater than desired or anticipated, it appears to be a result of a new OPEC policy designed to stimulate demand for oil and curtail production of competing high-cost oil and competing alternative energy sources.

As a result of this new strategy, OPEC production is already on the rise and is expected to be over 18.5 million b/d in 1986. This outlook is based upon expectations due to economic forces and doesn't attempt to forecast political events. However, a political upheaval could have some impact on worldwide supply. Of most concern is the closing of the Strait of Hormuz due to action in the Iran-Iraq war. At the present time, about 6.6 million b/d is being exported via the Strait of Hormuz. The free-world total imports are somewhere close to 25.3 million b/d. Therefore, 26% of total free-world import requirements would be eliminated if the Strait was closed. It is estimated that 3 million b/d could be made up by increasing production in other countries with surplus capacity and by diverting some of the Saudi Arabian export stream via the pipeline to the Red Sea.

If the remaining OPEC countries did not increase production sufficiently to cover the 3-4 million b/d shortfall, prices could move up sharply. But the impact on prices would be dependent upon what action was taken to reopen the Strait.

If it appeared that the closing was only temporary, the industrial countries and international oil companies might simply draw down stock levels to meet the demand.

The potential impact has been reduced in recent years, along with the reduction in dependency upon imports through the Strait of Hormuz. Three years ago, 8.4 million b/d, 36% of free-world imports, were coming through the Strait. However, with the upswing in Saudi



FREE WORLD ACTIVE RIG COUNT

Annual average

Region	1977	1978	1979	1980	1981	1982			1983			1984			1985		
	Total	Total	Total	Total	Total	Land	Off.	Total	Land	Off.	Total	Land	Off.	Total	Land	Off.	Total
Canada	218	272	339	401	264	194	5	199	190	11	201	245	14	259	302	9	311
United States	2,001	2,255	2,176	2,910	3,969	2,801	316	3,117	1,972	257	2,229	2,158	271	2,429	1,722	254	1,976
North America	**2,219**	**2,527**	**2,515**	**3,311**	**4,233**	**2,995**	**321**	**3,316**	**2,162**	**268**	**2,430**	**2,403**	**285**	**2,688**	**2,024**	**263**	**2,287**
Argentina	68	72	63	76	70	65	2	67	73	0	73	82	0	82	81	0	81
Brazil	45	52	60	72	81	63	31	94	54	29	83	44	26	70	46	30	76
Mexico	148	167	205	215	218	180	22	202	160	27	187	166	30	196	163	33	196
Venezuela	20	33	47	52	63	52	17	69	29	12	41	21	9	30	23	10	33
Others	54	58	65	66	89	74	16	90	54	13	67	48	13	61	46	11	57
Latin America	**335**	**382**	**440**	**481**	**521**	**434**	**86**	**522**	**370**	**81**	**451**	**361**	**78**	**439**	**359**	**84**	**443**
India	43	40	40	43	44	41	9	50	42	14	56	40	17	57	47	16	63
Indonesia	46	62	66	77	86	60	32	92	62	26	88	56	26	82	56	24	80
Others	70	79	111	122	125	92	43	135	92	39	131	83	36	119	79	39	118
Far East	**159**	**181**	**217**	**242**	**255**	**193**	**84**	**277**	**196**	**79**	**275**	**179**	**79**	**258**	**182**	**79**	**261**
Algeria	108	101	109	111	91	81	0	81	54	0	54	27	0	27	35	0	35
Libya	23	28	33	41	33	29	2	31	23	1	24	24	2	26	28	2	30
Nigeria	16	16	18	20	23	16	11	27	9	8	17	6	5	11	7	3	10
Others	26	31	41	47	66	29	38	67	19	32	51	15	25	40	15	28	43
Africa	**173**	**176**	**201**	**219**	**213**	**155**	**51**	**206**	**105**	**41**	**146**	**72**	**32**	**104**	**85**	**33**	**118**
Germany-West	21	22	21	22	26	31	0	31	25	0	25	19	0	19	20	0	20
Italy	12	18	21	19	32	31	7	38	19	7	26	20	6	26	31	9	40
United Kingdom	36	34	34	48	58	2	56	58	2	40	42	5	55	60	7	56	63
Others	71	70	76	90	102	73	37	110	61	31	92	67	31	98	69	41	110
Western Europe	**140**	**144**	**152**	**179**	**218**	**137**	**100**	**237**	**107**	**78**	**185**	**111**	**92**	**203**	**127**	**106**	**233**
Abu Dhabi	15	16	20	23	31	18	23	41	12	23	35	10	19	29	10	11	21
Egypt	20	16	21	26	27	14	22	36	16	19	35	16	20	36	16	21	37
Saudi Arabia	21	22	22	25	29	16	13	29	14	12	26	9	7	16	7	4	11
Turkey	16	17	9	24	26	34	0	34	26	0	26	23	0	23	25	0	25
Others	120	120	72	79	57	52	8	60	72	9	81	85	7	92	98	8	106
Middle East	**192**	**191**	**144**	**177**	**170**	**134**	**66**	**200**	**140**	**63**	**203**	**143**	**53**	**196**	**156**	**44**	**200**
Australia	7	10	11	15	23	24	8	32	15	10	25	24	10	34	22	9	31
Others	1	2	2	3	3	2	0	2	3	0	3	2	1	3	5	1	6
South Pacific	**8**	**12**	**13**	**18**	**26**	**26**	**8**	**34**	**18**	**10**	**28**	**26**	**11**	**37**	**27**	**10**	**37**
Total Free World	**3,226**	**3,613**	**3,682**	**4,627**	**5,636**	**4,074**	**718**	**4,792**	**3,098**	**620**	**3,718**	**3,295**	**630**	**3,925**	**2,960**	**619**	**3,579**
Total excl. North America	**1,007**	**1,086**	**1,167**	**1,316**	**1,403**	**1,079**	**397**	**1,476**	**936**	**352**	**1,288**	**892**	**345**	**1,237**	**936**	**356**	**1,292**

Source: Hughes Tool Co.

Arabian and OPEC production, the Strait will regain its importance.

The search for oil throughout the world outside the U.S. has not dropped as sharply as crude oil prices. The international oil companies have found that there is substantially more profit margin in equity crude than in crude purchased from OPEC exporters, so they have continued the search in those areas where they can obtain favorable exploration/development agreements.

The number of active drilling rigs outside the U.S. hasn't fallen as sharply as prices.

The number of active drilling rigs outside the U.S. and Canada peaked in 1982 at 1,476. The active rig count fell to 1,288 in 1973, 1,237 in 1984 but went back up to 1,292 in 1985. This is down 12.5% from the 1982 peak, but is still higher than the years prior to 1980. The most activity in 1985 was in Latin America, where there were 443 active rigs. There were 261 active rigs in the Far East, 233 in Western Europe, 200 in the Middle East and 118 in Africa.

Up until the recent collapse in prices, one of the major reasons for the high level of activity in the face of declining demand was the relatively high price of oil. Since the price of oil far surpassed the general rate of inflation over the past decade, the profit margin increased considerably. Previously uneconomic or marginal fields were being developed throughout the world, and huge import bills encouraged countries without sufficient production to stimulate exploration activities.

Looking to the future, as oil becomes more difficult to find, particularly in large quantities, activity must increase in order to maintain reserves.

The ratio of reserves to production hasn't changed markedly over the past 10 years.

The result of this active search has been the maintenance of worldwide reserves. Total world reserves moved up to 700.1 billion barrels as of the first of 1986. Compared to 10 years earlier, reserves were down only 16 billion barrels, a drop of 2.2%. OPEC reserves represented 67.9% of total world reserves at 475.2 billion barrels. OPEC reserves were down only 2.1% from 1975. Worldwide reserves have been replaced throughout a period of peak consumption. This is attributable to the increased value of the oil and the increased exploration activity.

The reserves/production ratio was 35.2 years in 1975. This fell to 26.7 years in 1979, the year of peak production. In 1984, the ratio moved up to 31.7 years. It is estimated at 32.8 years in 1986.

The reserves/production ratio has been maintained and there is no apparent immediate pressure on oil availability. However, it is evident from the reserves profile that OPEC still holds the key position in future world supply.

Investment in exploration and production activity will have to be sustained if the reserves-to-production ratio is to be maintained at this level. And unless activity is sustained in the non-OPEC areas, the OPEC influence over production and prices will be re-established in the near future.

The worldwide refining industry has gone through a somewhat similar cycle brought about by the volatile change in prices.

The refining industry found itself with substantial excess capacity as demand fell.

With the drop in demand for petroleum products, crude runs through refineries also fell sharply. As refinery runs fell, excess capacity developed in the refining industry. Refining capacity represents a substantial fixed investment in plant and equipment. Therefore, capacity adjustment to the declining demand was a slow process.

There was an initial delay as refineries attempted to determine if the peaking of demand, and subsequent decline, was a temporary phenomenon, or if it was a permanent demand adjustment that would

OPEC REFINING CAPACITY

Country	1980	(Dec 31) 1982	1984	Change 1984-1980	% change 1984/1980
	(1,000 b/d)				
Algeria	471.2	471.2	471.2	—	—
Ecuador	94.5	94.5	94.6	0.1	0.1
Gabon	44.0	44.0	44.0	—	—
Indonesia	499.7	499.7	879.7	380.0	76.0
Iran	1,320.0	670.0	615.0	-705.0	-53.4
Iraq	305.5	215.5	365.5	60.0	19.6
Kuwait	594.0	594.0	614.0	20.0	3.4
Libya	130.0	130.0	350.0	220.0	169.2
Nigeria	247.0	247.0	247.0	—	—
Qatar	10.5	12.2	62.2	51.7	492.4
Saudi Arabia	878.0	878.0	1,298.0	420.0	47.8
United Arab Emirates	15.0	135.0	180.0	165.0	1,100.0
Venezuela	1,444.9	1,323.1	1,224.0	-220.9	-15.3
Total OPEC	**6,054.3**	**5,314.2**	**6,445.2**	**390.9**	**6.5**

Source: OPEC Statistical Bulletin

WORLDWIDE EXCESS PRODUCTIVE CAPACITY

	Production			Productive capacity*			Excess capacity			% of	
	OPEC	Non-OPEC	Total Non-Comm	OPEC	Non-OPEC	Total Non-Comm	OPEC	Non-OPEC	Total Non-Comm	Total capacity	Total production
	(1,000 b/d)										
1960			17,668			19,100			1,432	7.50	8.11
1961	9,364	9,319	18,683	10,150	10,050	20,200	786	731	1,517	7.51	8.12
1962	10,508	9,663	20,171	11,350	10,450	21,800	842	787	1,629	7.47	8.08
1963	11,514	10,036	21,550	12,450	10,850	23,300	936	814	1,750	7.51	8.12
1964	12,984	10,206	23,190	14,050	11,050	25,100	1,066	844	1,910	7.61	8.24
1965	14,339	10,552	24,891	15,500	11,400	26,900	1,161	848	2,009	7.47	8.07
1966	15,770	11,235	27,005	17,050	12,150	29,200	1,280	915	2,195	7.52	8.13
1967	16,850	12,155	29,005	18,200	13,150	31,350	1,350	995	2,345	7.48	8.08
1968	18,786	13,114	31,900	20,300	14,200	34,500	1,514	1,086	2,600	7.54	8.15
1969	20,907	13,569	34,476	22,600	14,650	37,250	1,693	1,081	2,774	7.45	8.05
1970	23,413	14,515	37,928	25,300	15,700	41,000	1,887	1,185	3,072	7.49	8.10
1971	25,326	14,575	39,901	27,400	15,750	43,150	2,074	1,175	3,249	7.53	8.14
1972	27,094	14,845	41,939	29,300	16,050	45,350	2,206	1,205	3,411	7.52	8.13
1973	30,989	14,942	45,931	33,500	16,150	49,650	2,511	1,208	3,719	7.49	8.10
1974	30,729	14,593	45,322	34,800	15,750	50,550	4,071	1,157	5,228	10.34	11.54
1975	27,155	14,418	41,573	36,100	15,600	51,700	8,945	1,182	10,127	19.59	24.36
1976	30,738	14,548	45,286	37,400	15,750	53,150	6,662	1,201	7,863	14.79	17.36
1977	31,278	15,595	46,873	38,700	16,850	55,550	7,422	1,255	8,677	15.62	18.51
1978	29,805	17,304	47,109	36,480	18,700	55,180	6,675	1,396	8,071	14.63	17.13
1979	30,928	17,708	48,636	34,260	19,150	53,410	3,332	1,442	4,774	8.94	9.82
1980	26,890	18,310	45,200	32,730	19,800	52,530	5,846	1,484	7,330	13.95	16.21
1981	22,624	18,853	41,477	31,200	20,400	51,600	8,576	1,547	10,123	19.62	24.41
1982	18,584	19,768	38,352	31,200	21,400	52,600	12,616	1,632	14,248	27.09	37.15
1983	17,317	20,718	38,035	31,200	22,400	53,600	13,883	1,682	15,565	29.04	40.92
1984	17,442	21,922	39,364	31,000	23,700	54,700	13,558	1,778	15,336	28.04	38.96
1985	16,011	22,531	38,542	30,000	24,400	54,400	13,989	1,869	15,858	29.15	41.14

*Estimated

WORLDWIDE EXPORT CRUDE OIL PRICES

Official Sales and Term Contract Prices
(Dollars per barrel - 1 January)

Year	Saudi Arabia Arabian Light 34°	Nigeria Bonny Light 37°	United Kingdom Brent 38°	Mexico Isthmus 33°	U.S.S.R. Export Blend 32°
1979	13.34	15.12	—	13.10	13.20
1980	26.00	29.97	26.02	32.00	33.20
1981	32.00	40.00	39.25	38.50	39.25
1982	34.00	36.50	36.60	35.00	35.49
1983	34.00	35.50	33.50	32.50	31.20
1984	29.00	30.00	30.00	29.00	28.60
1985	29.00	28.00	28.65	29.00	28.00
1986	28.00	28.65	26.00	26.21	28.15
June 1986	12.70	14.69	11.60	12.54	12.40

Source: Energy Information Administration

Developing OPEC export refineries may be a major issue in future years.

require adjustment in refining capacity. Based on the long-term forecasts that projected steadily increasing long-term demand, refineries initially adjusted by running at a lower utilization rate. As it became apparent that the downturn in demand was signaling a much lower long-term level of demand, refineries realized that the industry was faced with a massive excess capacity.

Faced with sharply reduced, and, in many cases, negative refining margins, refiners started to adjust capacity by mothballing or permanently closing facilities. Free-world refining capacity peaked in 1980 at 65.7 million b/d and remained relatively high in 1981 at 65.14 million b/d. Capacity has fallen 14.8% to 55.96 million b/d in 1985. Refiners started reducing capacity at a more rapid rate once they realized that demand was not going to rebound to previous levels.

The refinery utilization rate fell to an unprofitable 67.7% in 1982.

The refinery utilization rate for free-world refineries fell to 67.7% in 1982 from 75.3% in 1978. A cut in crude refining capacity, and an increase in demand, has boosted the rate up to 75.6% in 1985. Most of the improvement is attributable to the reduction in excess capacity. This improvement in refining utilization has improved refining profitability. But there is another threat to refining profitability emerging, and that is the increase in OPEC refining capacity. It appears apparent that some of the OPEC countries intend to carve out a portion of the refined products market.

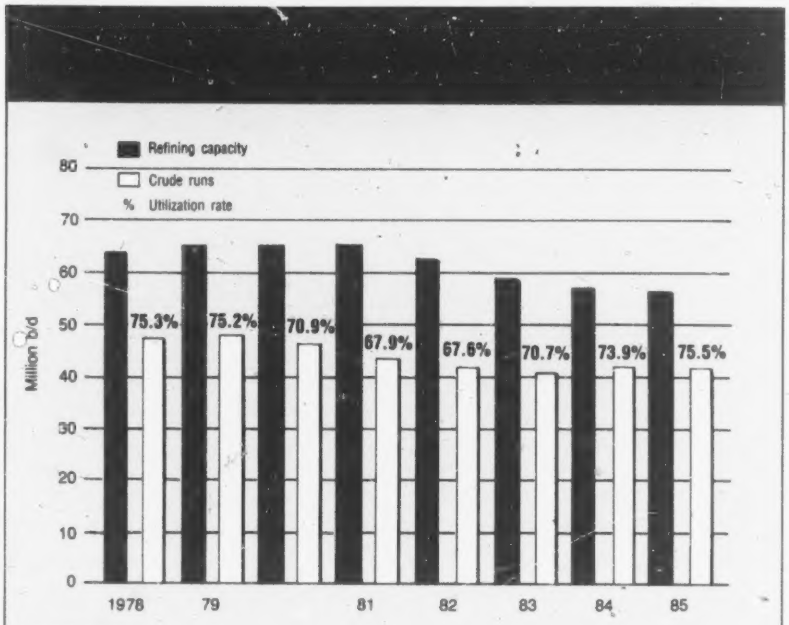
OPEC has plans to increase their refining capacity substantially. Plans are being reviewed, but they had planned to boost capacity to 8.5 million b/d. OPEC will not only be supplying a much greater percentage of their own internal petroleum product requirements, but will also be expanding their role in the product export market. The OPEC capacity in 1984 was 6.4 million b/d. Excluding Iran, whose refining capacity was severely damaged in the war with Iraq, OPEC capacity in 1984 was up 23.2% from 1980.

This may really be one of the major issues of concern to the world oil industry in the late 1980's. The major international oil companies have lost control over a substantial portion of world crude production. Now they will be meeting competition from OPEC in refining. This is probably also of concern to the major industrial countries. A great deal of revenue is derived from taxes on refined products. If OPEC is able to capture a portion of the refined product market, they may capture the revenue now collected as taxes by the industrial countries, or substantially drive up the prices of refined products.

The reluctance of refiners to adjust runs immediately to the initial drop in demand, coupled with a reluctance to break long-term contractual agreements for crude from export nations, resulted in a huge buildup of stocks in 1980 and 1981. Stocks for the OECD group of countries increased 465 million bbl from 1978 to 1980, and peaked at 3,587 million bbl in 1980.

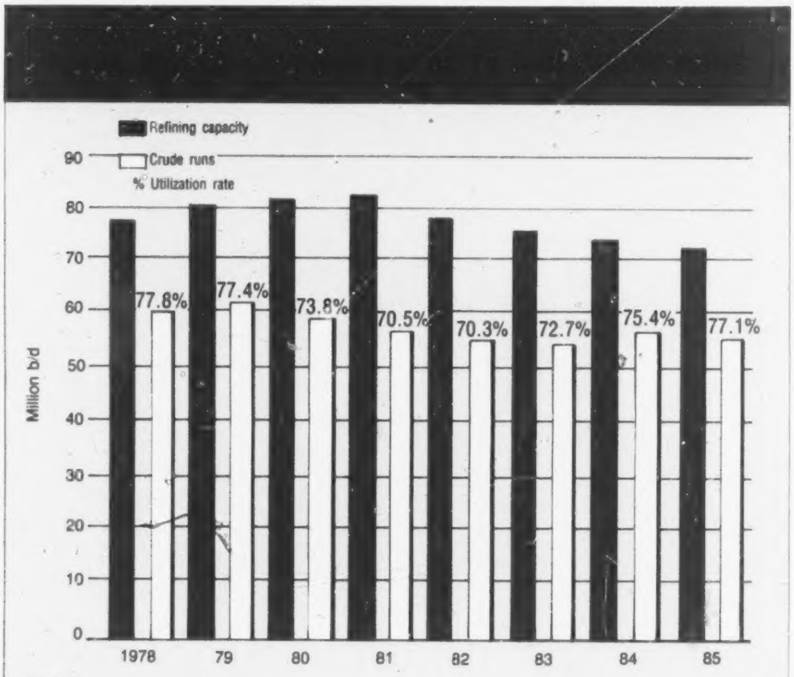
Refiners originally defended the high stock levels as a buffer against a potential supply disruption and a rebound in demand. But the acceleration in worldwide inflation brought high interest rates that translated into very high carrying costs for the excessive inventories. Refiners found it difficult to reduce stocks in the face of falling demand, but they made a concentrated effort by breaking long-term crude supply agreements and forcing stocks back into the ground by reducing offtakes from the producing countries. From 1980 to 1985, stocks of the OECD countries fell 305 million bbl. Stocks fell 155 million bbl in 1982 alone, contributing almost 500,000 b/d to the supply of crude, and reducing import demand.

As a portion of demand was supplied directly from inventory,



Refining capacity	63.5	64.8	65.7	65.1	62.3	59.3	57.8	56.0
Crude runs	47.8	48.7	46.6	44.2	42.1	41.9	42.7	42.3

Source: British Petroleum



Refining capacity	78.0	80.0	81.2	81.7	79.2	76.5	75.1	73.3
Crude runs	60.7	61.9	59.9	57.6	55.7	55.6	56.6	56.5

Source: British Petroleum

production and export levels fell at a faster rate than product demand. It is now felt refiners have reached an acceptable balance between demand and stocks, and that the inventory drawdown has stopped. Any increase in demand will be met by new production rather than a reduction in stocks. With demand expected to move upward throughout the forecast period, stocks will probably increase slightly as a balance is retained, in terms of days of supply. However, there may be some temporary stock increases as refiners try to take advantage of the low oil prices.

Worldwide natural gas production increased 35.6% from 1975 to 1985.

Over the past 10 years, the level of worldwide oil production has been influenced primarily by the price of oil, but competition from competing fuels has also been a factor. One of the major competing fuels has been natural gas. Worldwide production of natural gas has increased substantially over the past 10 years. Total world production in 1985 was 60.18 trillion cubic feet. This was an increase of 35.6% from 44.4 trillion cubic feet in 1975. Non-communist area production was 34.67 trillion cubic feet in 1985, up 8.6% from 31.93 trillion cubic feet in 1975.

The natural gas share of total primary energy consumption has moved up from 18.2% in 1975 to 20.1% in 1985. In the non-communist world, however, natural gas has lost some of its market share, slipping to 18.9% in 1985 from 19.2% in 1975. This is primarily due to a 11.6% drop in natural gas consumption in the U.S. over this ten-year period. U.S. production in 1985 was 17.22 trillion cubic feet, down 14.37% from 1975.

The communist-bloc countries posted the largest increase over the 1975-1985 period. Production increased 104.6% to 25.5 trillion cubic feet in 1985. This was an increase of 13.04 trillion cubic feet. This increase was mainly due to the increased production in the U.S.S.R. Production in the U.S.S.R. increased 122.2% over the ten-year period, up 12.47 trillion cubic feet to 22.68 trillion cubic feet in 1985. The U.S.S.R. passed the U.S. in 1983 to become the world's largest producing country. This increase in output enabled the U.S.S.R. to launch the massive level of natural gas exports to Western Europe. The U.S.S.R. also has a policy of transforming segments of their economy from oil-consuming to natural gas. This enables them to export greater volumes of crude oil.

North America was the only geographic area where natural gas production fell over the 1975–1985 period. In all other areas, production was up from +14.3% in Western Europe to +231.3% in Africa and +220% in Asia and Australia.

The huge proven gas reserves in the U.S.S.R. have enabled them to boost production. They have 43.1% of total world proven reserves as of January 1, 1986. At their present rate of production, they have 66 years of natural gas available. Total non-communist proven reserves represent a 55.9-year supply at the present rate of output. Iran has the largest reserves, 24.3% of non-communist and 13.5% of the total world.

U.S. reserves represent only 5.7% of the world total, and a reserves-to-production ratio of only 11.9 years at the present rate of production.

Outlook

The sharp drop in crude oil prices has substantially altered the medium-range outlook for worldwide supply. Both the level of production and the geographic pattern of supply have been altered by this sharp price correction.

OPEC PRODUCTION QUOTAS

Country	(1,000 b/d) 1983 quota	1983 production	1984* quota	1984 production	1985 production
Algeria	725	675	663	608	649
Ecuador	200	235	183	258	277
Gabon	150	150	137	150	153
Indonesia	1,300	1,385	1,189	1,423	1,225
Iran	2,400	2,426	2,300	2,174	2,257
Iraq	1,200	893	1,200	1,210	1,435
Kuwait	1,050	1,064	900	945	854
Libya	1,100	1,076	990	1,091	1,052
Nigeria	1,300	1,241	1,300	1,414	1,480
Qatar	300	295	280	396	299
Saudi Arabia	5,000	5,086	4,353	4,464	3,279
United Arab Emirates	1,100	1,147	950	1,159	1,142
Venezuela	1,675	1,768	1,555	1,711	1,558
Total	**17,500**	**17,441**	**16,000**	**17,003**	**15,660**

*Production quotas did not apply for full year

Source OPEC and Author's estimates

WORLDWIDE GAS RESERVES

	1973	1978	Jan. 1 1983 (Billion cu ft)	1985	1986	Change 1986-1973	% change 1986 1973
Australia	36.236	32.000	17.768	17.850	18.220	– 18.016	49.7
India	2.300	3.500	14.508	15.000	16.880	+ 14.580	+ 633.9
Indonesia	5.500	24.000	29.600	40.000	35.600	+ 30.100	+ 547.3
Malaysia	*10.000	17.000	34.000	50.000	52.700	+ 42.700	+ 427.0
Pakistan	16.000	15.500	18.540	15.760	15.400	600	3.8
Thailand	—	4.500	11.000	5.900	5.400	+ 5.400	—
Others	31.200	31.225	20.831	21.680	27.297	3.903	12.5
Total Asia-Pacific	**101,236**	**122,725**	**146,247**	**166,190**	**171,497**	**+ 70,261**	**+ 69.4**
Netherlands	88.000	60.000	51.920	68.482	67.070	– 20.930	23.8
Norway	15.000	20.000	58.000	89.000	104.000	+ 89.000	+ 593.3
United Kingdom	45.000	29.000	25.400	27.800	33.000	– 12.000	26.7
Others	30.400	29.190	21.416	21.391	22.337	8.063	26.5
Total Western Europe	**178,400**	**138,190**	**156,736**	**206,673**	**226,407**	**+ 48,007**	**+ 26.9**
Abu Dhabi	12.000	20.000	19.260	20.750	20.500	+ 8.500	+ 70.8
Iran	200.000	500.000	482.600	478.600	470.000	+ 270.000	+ 135.0
Iraq	25.000	28.000	28.800	28.800	29.000	+ 4.000	+ 16.0
Kuwait	33.000	31.500	29.900	32.500	32.500	500	1.5
Qatar	8.000	40.000	62.000	150.000	148.000	+ 140.000	+ 1.750.0
Saudi Arabia	50.000	85.000	117.000	123.270	121.000	+ 71.000	+ 142.0
Others	16.150	15.160	30.170	35.435	34.863	+ 18.713	+ 115.9
Total Middle East	**344,150**	**719,660**	**769,730**	**869,355**	**855,863**	**+ 511,713**	**+ 148.7**
Algeria	105.000	125.000	111.250	109.100	107.080	+ 2.090	+ 2.0
Libya	27.500	25.700	21.500	21.200	21.390	6.110	22.2
Nigeria	40.000	43.000	32.400	35.600	47.000	+ 7.000	+ 17.5
Others	16.515	13.804	24.273	21.276	22.852	+ 6.337	+ 38.4
Total Africa	**189,015**	**207,504**	**189,423**	**187,176**	**198,322**	**+ 9,307**	**+ 4.9**
Argentina	8.800	8.120	25.200	24.628	23.588	+ 14.788	+ 168.0
Mexico	11.500	30.000	75.850	77.000	76.954	+ 65.454	+ 569.2
Trinidad & Tobago	7.500	8.500	11.000	10.550	10.500	+ 3.000	+ 40.0
Venezuela	34.600	41.000	54.079	55.367	59.067	+ 24.467	+ 70.7
United States	271.455	210.000	204.000	198.000	197.000	– 74.455	– 27.4
Canada	55.000	58.000	97.000	92.300	99.700	+ 44.700	+ 81.3
Others	16.818	20.960	20.462	17.386	19.162	+ 2.344	+ 13.9
Total Western Hemisphere	**405,673**	**376,580**	**487,591**	**475,231**	**485,971**	**+ 80,298**	**+ 19.8**
Total Non-Communist	**1,218,474**	**1,564,659**	**1,749,727**	**1,904,625**	**1,938,060**	**+ 719,586**	**+ 59.1**
U.S.S.R.	635.400	920.000	1.240.000	1.450.000	1.500.000	+ 864.600	+ 136.1
Others	29.000	35.000	43.800	47.400	46.000	+ 17.000	+ 58.6
Total Communist	**664,400**	**955,000**	**1,283,800**	**1,497,400**	**1,546,000**	**+ 881,600**	**+ 132.7**
TOTAL WORLD	**1,882,874**	**2,519,659**	**3,023,527**	**3,402,025**	**3,484,060**	**+ 1,601,186**	**+ 85.0**
Total OPEC	**561,600**	**980,150**	**1,018,564**	**1,118,247**	**1,116,157**	**+ 554,557**	**+ 98.7**
OPEC as % of World	29.9%	38.9%	33.7%	32.9%	32.0%	—	—

*Includes Brunei

Source: Oil & Gas Journal

It is impossible to totally separate available supply of crude oil from the price level. They are closely interrelated and dependent upon each other. But since the price level has been the major issue of concern, it may be appropriate to address price expectations first.

Upward price pressure will re-emerge when the excess capacity is reduced.

With the large excess production capacity that exists in the world today, there is no upward pressure on prices. Upward pressure on prices will only re-emerge when a substantial portion of the excess capacity is eliminated. This would happen due to increased demand and/or a decrease in production. A decrease in production in areas that are producing at or near capacity or in areas where capacity and production are synonymous. This is true mainly in non-OPEC areas.

Without any substantial upward pressure, prices are expected to move up only gradually over the forecast period 1986-1991. The average world export price of crude will bottom-out in 1986 and move up slowly as demand increases. Toward the end of the forecast period, OPEC production will have increased to a level at which there would be a possibility for the group to boost prices. At that point, probably 1990-1991, the price level will depend upon the willingness of Saudi Arabia to meet demand by increasing output and capacity. It would appear to be in the Saudis' best interests to keep prices from flying up again and encouraging investment in alternative energy. Prices are expected to increase substantially; however, from an average $14/bbl in 1986 to $22/bbl in 1991, an increase of 57%. But not a sharp increase that would stifle demand.

The much-lower current and real price of oil will boost demand for oil throughout the forecast period 1986-1991. Total world production will increase 11.5%, up 6.7 million b/d, to 65.27 million b/d in 1991. Free-world production is expected to move up even faster, increasing 14.3% to 49.57 million b/d in 1991.

Non-OPEC production will fall during the forecast period at the lower oil prices.

The lower oil prices will have a negative impact on exploration and development in high-cost areas. These are mainly non-OPEC areas. Therefore, non-OPEC output is expected to slip downward very gradually throughout the period. By 1991, non-OPEC production will be down 2.6% to 24.19 million b/d.

Communist production will not be a major factor over the forecast period. Production is expected to rise only a modest 500,000 b/d, up 3.3%.

With increasing demand for crude oil, and stable-to-falling non-OPEC production, OPEC output will have to increase to fill the gap. OPEC production will increase 6.87 million b/d, up 37.1%, to 25.4 million b/d in 1991. OPEC production will move up steadily over the period. By 1990, a substantial portion of the excess capacity will have been employed. At that time, OPEC may be in the position to put pressure on increasing prices.

OPEC production will increase to over 25 million b/d by 1991.

By the end of the forecast period, OPEC output will have climbed to 51.2% of non-communist production and 38.9% of total world production.

With an increase in the crude oil price, the number of active drilling rigs outside of the U.S. and Canada is expected to move up again. The number of active rigs is expected to increase 32.9% to 1,375 rigs in 1991. There is a close correlation between rig activity and the price of crude oil.

Worldwide refining capacity will remain at the 1986 level, declining a little early in the forecast period, and then increasing toward the end. Worldwide refining capacity is still being adjusted to the lower level of petroleum product demand that was a result of the 1970's price shocks. Refining profitability is substantially affected by the utilization rate. Refiners will try to boost the rate over 80% to increase margins. There is sufficient capacity in place to meet the increased demand that is expected over the 1986–1991 period.

Crude runs are expected to increase with demand, moving up 14.3% to 48.36 million b/d in 1991. Increased throughput will result in a substantial increase in the utilization rate. The rate will move up to 86.7% in 1991 from only 76.1% in 1986.

There is not expected to be any major geographical shift in natural gas production over the forecast period. The U.S.S.R. is expected to continue to develop their vast reserves, and they are expected to continue to supply European energy needs.

Natural gas resource development is expected to continue to expand over the 1986–1991 period. But the area with the largest reserves, the Middle East, is politically unsettled and a long distance from the larger consuming areas. Therefore, any increase in output is not expected to be major or to have a major impact on world energy needs. However, increased natural gas development for internal consumption in this area would release additional crude for export. That would reduce the upward pressure on prices resulting from increased crude oil demand.

THE OUTLOOK — WORLDWIDE SUPPLY

	1986	1987	1988	1989	1990	1991	Change 1986 to 1991	% change 1986 to 1991
WORLD OIL PRODUCTION (thousand barrels/day)								
OPEC	18,505	19,985	21,330	22,545	23,945	25,375	+6,870	+37.1
Non-OPEC	24,845	24,715	24,590	24,440	24,315	24,190	− 655	− 2.6
Total Non-Communist	**43,350**	**44,700**	**45,920**	**46,985**	**48,260**	**49,565**	**+ 6,215**	**+14.3**
Communist	15,200	15,300	15,400	15,500	15,600	15,700	+ 500	+ 3.3
Total	**58,550**	**60,000**	**61,320**	**62,485**	**63,860**	**65,265**	**+6,715**	**+11.5**
WORLD REFINING (Non-Communist)								
Capacity (thousand barrels/day)	55,600	55,100	55,400	55,400	55,600	55,800	+ 200	+ 0.4
Crude runs (thousand barrels/day)	42,300	43,620	44,810	45,850	47,090	48,360	+ 6,060	+14.3
Utilization rate (%)	76.1	79.1	80.9	82.8	84.7	86.7	—	—
Active drilling rigs (outside U.S. & Canada)	1,035	1,095	1,165	1,200	1,250	1,375	+ 340	+32.9
Crude oil price (av. world export price) ($/barrel)	14.00	16.00	17.00	18.00	20.00	22.00	+8.00	+57.1

U.S. OUTLOOK—DEMAND

U.S. OUTLOOK—DEMAND

THE SHARP DROP in oil prices will have a substantial impact on the demand for petroleum products in the U.S. The U.S. economy is still driven to a large extent by the consumption of petroleum and natural gas. In 1985, these two fuels provided almost two-thirds of the energy consumed in the U.S.

There has been a substantial amount of conservation and fuel switching over the past years, since the price hike of 1979-1981. But these efforts have been aimed at using resources in the most efficient manner. With oil and natural gas energy being substantially less costly, greater consumption could be viewed as the most efficient allocation of resources.

Industry and utilities now have multiple fuel capabilities and can easily switch consumption to the lowest-cost fuel. And much consumer conservation was discretionary. With lower-cost petroleum products, the incentive for this personal conservation is greatly diminished.

Review

Oil and natural gas are just two of the fuels that provide energy for economic activity, but they are essential for activity that expands the level of economic output in the U.S. The demand for energy and demand for petroleum products and natural gas are dependent upon the level of economic output, and this forecast outlook of future demand is dependent upon assumptions concerning the level of U.S. economic activity.

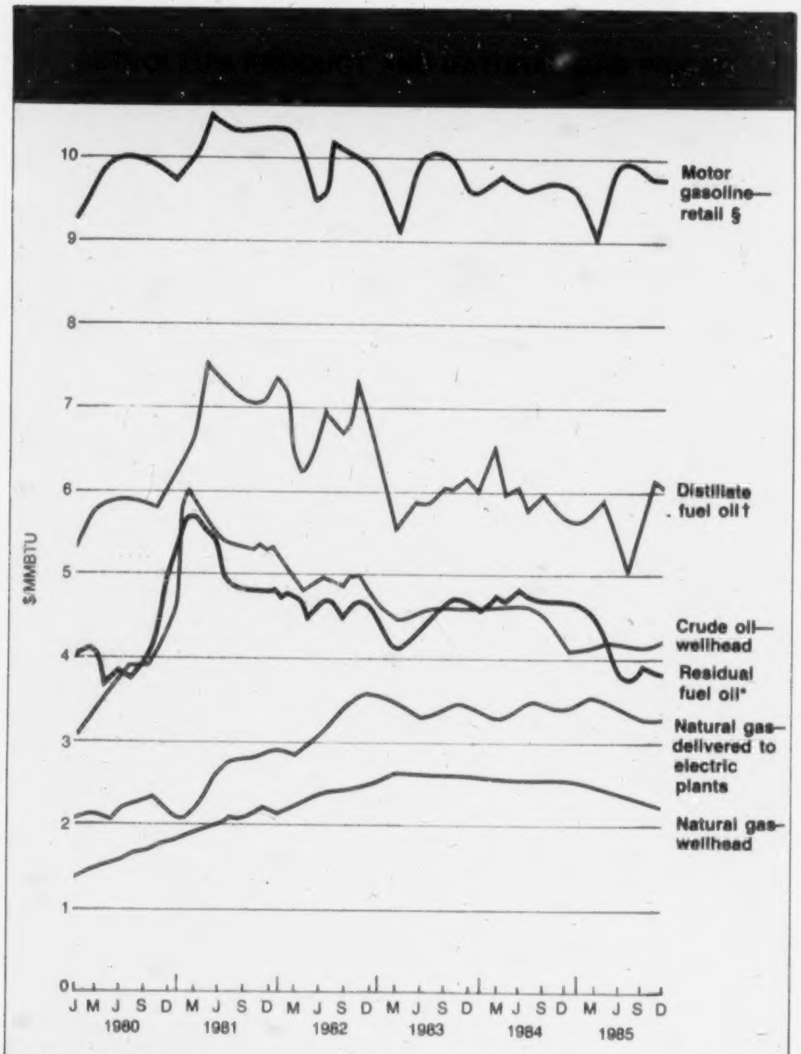
Since 1973, the U.S. economy has gone through two recessions. Both followed major increases in oil prices and increases in energy costs in general. One recession was in 1974-1975 when real Gross National Product (GNP), expressed in 1982 dollars, fell 1.8% over 2 years. The second occurred in 1982, when real GNP fell 2.5%. Between 1978 a[illegible]982, the economy grew only 1.6%; virtually not at all. The U.S. economy began pulling out of the most recent recession during 1983. Real GNP moved up 3.5% in 1983. The pace of economic growth accelerated in 1984 with real GNP increasing 6.5%. GNP moved up a modest 2.2% in 1985.

The lock-step relationship between economic growth and energy demand in the U.S. was broken in 1970. From 1950 through 1970, real GNP increased 101.2%. Over the same period, energy consumption increased 97.5%. The amount of energy consumed per real dollar of GNP fell only slightly, from 28,200 BTU per dollar of GNP in 1950 to 27,800 BTU in 1970.

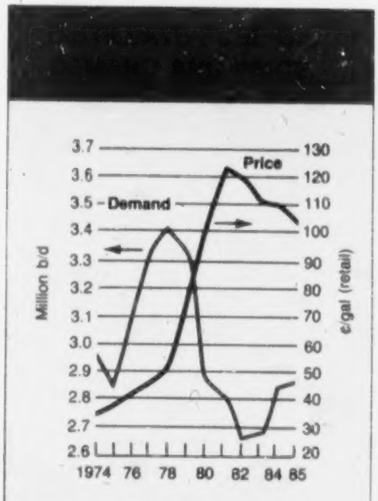
GNP increased 47.8% from 1970–1985, but energy consumption increased only 10%.

From 1970 through 1985, GNP increased 47.8% but energy consumption moved up only 10%. Over that 15-year period, the growth of energy and GNP moved from a one-to-one relationship to a 0.21-to-one relationship, meaning that energy consumption increased only 2.1% for every 10% increase in economic activity. This was a dramatic shift from the previous 20 years.

Total energy consumption per GNP dollar fell for fifteen consecutive years, from 27.8 thousand BTU in 1970 to 20.7 thousand in 1985.



*Retail, excluding tax
†Refiners average selling price to resellers & retailers
§Average all grades, including tax
Source: Energy Information Administration



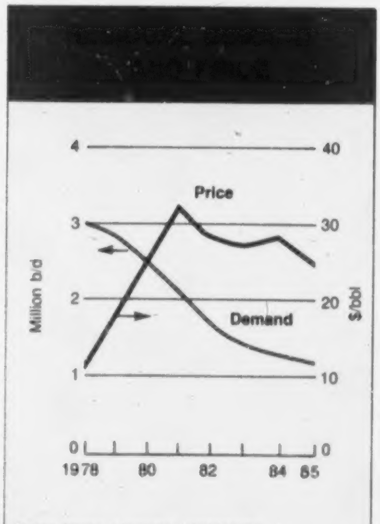
Source: American Petroleum Institute and Energy Information Administration

PRICES OF FOSSIL FUELS USED IN ELECTRIC GENERATION

	Coal	Residual oil	Natural gas	All fossil fuels	Residual oil price as % of Coal	Residual oil price as % of Natural gas
	(¢/MMBTU)					
1973	40.5	78.5	33.8	47.6	193.8	232.2
1974	70.9	189.0	48.2	91.4	266.6	392.1
1975	81.4	200.5	75.2	104.4	246.3	266.6
1976	84.8	195.2	103.4	111.9	230.2	188.8
1977	94.7	219.8	129.1	129.7	232.1	170.3
1978	111.6	212.5	142.2	141.1	190.4	149.4
1979	122.4	298.8	174.9	163.9	244.1	170.8
1980	135.1	426.7	219.9	192.8	315.8	194.0
1981	153.2	533.4	280.5	225.6	348.2	190.2
1982	164.7	483.2	337.6	224.9	293.4	143.1
1983	165.6	457.8	347.4	220.6	276.4	131.8
1984	166.4	481.2	358.3	219.2	289.2	134.3
1985	164.9	424.6	343.2	209.7	257.5	123.7

*Delivered price to steam-electric utility plants

Source: Energy Information Administration



Source: Energy Information Administration

This was a 25.5% improvement in the efficiency of energy consumed. The rapid increase in the price of energy in the 1970s was a major reason for the improvement in energy efficiency. The rising cost of energy relative to other factors of production provided cost-cutting and profit incentive for minimizing energy requirements.

The oil price hikes of 1973-1974 and 1979-1981 rapidly boosted the cost of petroleum products and the cost of energy in general. This had the effect of providing additional incentive for conservation and accelerated the drop in energy use per dollar of GNP.

Following the 1973-1974 price hike, the economy went into a recession, with real GNP falling in 1974 and 1975. Energy consumption fell from 74,282 trillion BTU in 1973 to 70,546 trillion BTU in 1975, a decline of 5%. Following the 1979-1981 price hike, the economy went into a recession in 1982. Due to the price-induced conservation, energy consumption actually started falling in 1980, and the fall accelerated with the drop in economic activity. Energy consumption fell for four consecutive years, dropping 10.7% from 78,898 trillion BTU in 1979 to 70,495 trillion BTU in 1983.

Oil prices have been falling since 1981, and other energy costs have also started to move down. This has moderated the incentive for conservation. During 1984, real GNP increased 6.5% and energy consumption moved up 5.1%. This is a ratio of 0.78 to 1, and is a sharp increase in relative energy consumption. But conservation has not stopped. In 1985, GNP increased 2.2% while energy consumption fell 0.3%.

Petroleum energy consumed per dollar of GNP has also been falling, particularly since the second oil price hike in 1979. Petroleum energy consumed per dollar of GNP fell from 12.5 thousand BTU in 1977 to 8.6 thousand BTU in 1985.

A substantial part of the more efficient use of energy has been due to price-induced conservation following the rapid and sharp increase in energy costs. But the shift in the profile of the economy has also been an important factor. The U.S. is moving from a principally industrial economy to a more service- and information-oriented economy. These latter types of economic activity are far less energy intensive.

The conservation and fuel switching response to price increases are spread over a long period.

The response to price increases can be spread out over an extended period. It is rapid in the transportation sector, but much slower in the residential/commercial, utility and industrial sectors. In those sectors, adjustment can extend over 10 or more years. A major portion of this demand adjustment is permanent, since it is due to investment in improved capital goods.

In the U.S. there has been a shift in energy consumption, away from the industrial sector to the residential/commercial and transportation sectors. Consumption in the industrial sector has dropped from 31.54 quads in 1973 to 25.75 quads in 1983, a drop of 18.4%. The industrial sector share of total energy consumption dropped from 42.5% to 36.5%. This reflects conservation and more efficient use of energy in the industrial sector, as well as the diminishing importance of the industrial sector in the total economy. However, there was a rebound in energy consumption by the industrial sector in 1984. Energy consumption in this sector moved up 7.9% to 27.77 quads, 37.5% of total energy. Industrial consumption of energy slipped a bit in 1985 to 27.01 quads, 36.5% of the total energy consumed. Expectations are that the relative importance of the industrial sector will continue to slide, but an upturn in economic activity would slow the slide.

FACTORS DETERMINING MOTOR GASOLINE DEMAND

	Total vehicle registrations* (1,000)	Total vehicle miles of travel (Billion)	Car registration (1,000)	Average age of cars	Fuel consumed per car (Gallons)	Miles traveled per car	Miles per gallon
1970	108,418	1,120.7	88,775	5.6	735	9,978	13.57
1975	132,962	1,330.1	106,077	6.0	712	9,634	13.53
1980	155,890	1,520.9	120,866	6.6	603	9,135	15.15
1981	158,457	1,556.5	122,604	6.9	579	9,002	15.54
1982	159,510	1,592.5	122,763	7.2	587	9,533	16.25
1983	163,861	1,649.1	125,773	7.4	578	9,654	16.70
1984	168,607	1,726.7	129,067	7.5	579	9,809	16.94

*Excludes military vehicles

Source: Motor Vehicle Manufacturers Assoc. Facts & Figures Report 1985; EIA

REFINED PRODUCT PRICES

	Regular motor gasoline pump price (¢/gal)	No. 2 heating oil retail price (¢/gal)	Value of petroleum imports ($/bbl)	Refiners' acquisition cost composite ($/bbl)
1972	36.13	19.72	2.47	3.58
1973	38.82	22.75	3.30	4.15
1974	52.41	36.01	10.81	9.07
1975	57.22	38.98	11.19	10.38
1976	59.47	41.80	12.15	10.89
1977	63.07	47.37	13.81	11.96
1978	65.71	50.80	14.12	12.46
1979	87.79	72.80	18.72	17.72
1980	121.72	100.97	30.60	28.07
1981	131.10	124.66	34.28	35.24
1982	122.20	120.86	31.48	31.87
1983	115.70	110.12	28.58	28.99
1984	112.90	110.10	28.11	28.63
1985	111.50	105.00	26.50	26.76

Source: American Petroleum Institute and Energy Information Administration

CRUDE OIL PRICES

	Saudi Light (Jan.1)	U.S. average wellhead	Refiners' acquisition cost Domestic	Refiners' acquisition cost Imported	Refiners' acquisition cost Composite
	(Dollars per barrel)				
1970	1.35	3.18	3.46	2.96	3.40
1971	1.75	3.39	3.68	3.17	3.60
1972	1.90	3.39	3.67	3.22	3.58
1973	2.10	3.89	4.17	4.08	4.15
1974	10.84	6.87	7.18	12.52	9.07
1975	10.46	7.67	8.39	13.93	10.38
1976	11.51	8.19	8.84	13.48	10.89
1977	12.09	8.57	9.55	14.53	11.96
1978	12.70	9.00	10.61	14.57	12.46
1979	13.34	12.64	14.27	21.67	17.72
1980	26.00	21.59	24.23	33.89	28.07
1981	32.00	31.77	34.33	37.05	35.24
1982	34.00	28.52	31.22	33.55	31.87
1983	34.00	26.19	28.87	29.30	28.99
1984	29.00	25.88	28.53	28.88	28.63
1985	29.00	24.08	26.65	27.03	26.76
Change 1981-1985	-3.00	-7.69	-7.68	-10.02	-8.48
% change 1981-1985	-9.4%	-24.2%	-22.4%	-27.0%	-24.1%
Change 1970-1985	27.65	20.90	23.19	24.07	23.36
% change 1970-1985	2048.1%	657.2%	670.2%	813.2%	687.1%

Source: Energy Information Administration

REFINED PETROLEUM PRODUCTS SUPPLIED BY TYPE

(Million b/d)

	Motor gasoline	% of total	Jet fuel	% of total	Distillate fuel oil	% of total	Residual fuel oil	% of total	Ethane and liquefied gases	% of total	Other products	% of total	Total products	% of total	% change from previous year
1973	6.67	38.5	1.06	6.1	3.09	17.9	2.82	16.3	1.45	8.4	2.21	12.8	17.31	100.0	5.7
1974	6.54	39.3	0.99	5.9	2.95	17.7	2.64	15.8	1.41	8.5	2.13	12.8	16.65	100.0	-3.8
1975	6.67	40.9	1.00	6.1	2.85	17.5	2.46	15.1	1.33	8.1	2.00	12.3	16.32	100.0	-2.0
1976	6.98	40.0	0.99	5.6	3.13	17.9	2.80	16.0	1.40	8.1	2.16	12.4	17.46	100.0	7.0
1977	7.18	38.9	1.04	5.6	3.35	18.2	3.07	16.7	1.42	7.7	2.37	12.9	18.43	100.0	5.6
1978	7.41	39.3	1.06	5.6	3.43	18.2	3.02	16.0	1.41	7.5	2.51	13.4	18.85	100.0	2.3
1979	7.03	38.0	1.08	5.8	3.31	17.9	2.83	15.3	1.59	8.6	2.67	14.4	18.51	100.0	-1.8
1980	6.58	38.6	1.07	6.3	2.87	16.8	2.51	14.7	1.47	8.6	2.57	15.0	17.06	100.0	-7.8
1981	6.59	41.0	1.01	6.3	2.83	17.6	2.09	13.0	1.47	9.1	2.08	13.0	16.06	100.0	-5.9
1982	6.54	42.7	1.01	6.6	2.67	17.5	1.72	11.2	1.50	9.8	1.86	12.2	15.30	100.0	-4.7
1983	6.62	43.5	1.04	6.8	2.69	17.7	1.42	9.3	1.51	9.9	1.94	12.8	15.23	100.0	-0.5
1984	6.69	42.5	1.18	7.5	2.84	18.1	1.37	8.7	1.57	10.0	2.08	13.2	15.73	100.0	-3.3
1985E	6.82	43.4	1.19	7.6	2.86	18.2	1.19	7.6	1.61	10.3	2.03	12.9	15.70	100.0	-0.2

E—Estimate
Source: Energy Information Administration.

The economy is shifting to a more service and information orientation.

Residential/commercial sector energy consumption has increased from 24.14 quads in 1973 to 26.78 quads in 1985, an increase of 10.9%. This sector's share of the total market increased from 32.5% to 36.2%. The growth in this sector of the economy has more than offset the improvement in energy efficiency and conservation. Growth in this sector is expected to be slow but steady over the forecast period, reflecting the shift to a more service- and information-oriented economy.

Consumption of energy in the transportation sector has also increased over this period, moving up 8.1% from 18.60 quads in 1973 to 20.11 quads in 1985. The share of total energy consumption increased from 25% to 27.2%. Although there has been continued improvement in vehicle fuel efficiency, the total vehicle fleet has been increasing along with the population. And as gasoline and diesel fuel prices have leveled off during the past 2 years, there has been less incentive for discretionary conservation. Energy consumption in this sector was up 5.1% over the past two years.

There has not only been a shift in the end use of energy, but also a shift in the source of energy. Over the past 12 years, coal and nuclear energy have been growing in share of the energy market, while petroleum and natural gas have been declining. The increase in demand for energy in the form of electrical power has been the primary reason for the increase in coal consumption and nuclear power generation. This is due to the changing nature of the economy. This is also part of the shift to a more service-oriented, information-oriented and automated economy.

Coal energy consumption moved up 34.8% between 1973 and 1985. Coal increased its share of the total energy market from 17.5% to 23.7% in 1985.

Energy from nuclear electric power increased 357%, from 0.91 quads in 1973 to 4.16 quads in 1985. The nuclear share of the energy market increased from 1.2% in 1973 to 5.6% in 1985.

Other forms of energy, primarily hydroelectric and geothermal, provided 4.8% of total energy consumed in 1985. This is up from 4.1% in 1973. Most of this energy comes from hydropower, where the maximum capacity cannot change from year to year and output is dependent upon the weather.

Over this 1973 to 1985 period, the petroleum share of the energy market fell from 46.9% to 41.8% in 1985. Energy from petroleum in 1985 was 11.2% lower than 1973, while total energy consumption was down only 0.5%.

The natural gas share of the total energy market has fluctuated more from year to year than petroleum, but it has also moved down since 1973. Natural gas represented 30.3% of the market in 1973 and was down to 24.1% in 1985. Energy from natural gas was down 20.9% to 17.82 quads in 1985, from 22.51 quads in 1973.

In 1973 petroleum and natural gas combined accounted for 77.2% of the energy consumed in the U.S. This was down to 65.9% in 1985—a definite downward trend, but still almost two-thirds of all energy consumed in the U.S.

Adjustment to the rising cost of energy not only takes the form of conservation, but also the form of fuel switching. Fuel switching takes time. This is a reaction to price change that is spread out over many years. It requires a substantial capital investment in most cases and, therefore, the response is dependent upon a more complex economic evaluation, one which includes the capital investment cost of alternative fuel facilities.

ECONOMIC GROWTH AND ENERGY CONSUMPTION

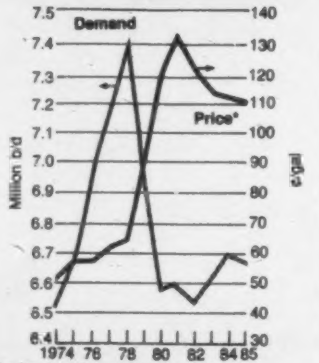
Year	GNP constant 1982 dollars (Billion)	Total energy consumption (Trillion BTU)	Total energy consumption per GNP dollar (Thousand BTU)	Petroleum energy consumption (Trillion BTU)	Petroleum energy consumption per GNP dollar (Thousand BTU)
1929	711.8	23,756	33.4	5,521	7.8
1933	501.6	16,900	33.7	4,833	9.6
1940	775.0	23,589	30.4	7,407	9.6
1946	1,077.8	30,494	28.3	10,002	9.3
1950	1,206.6	33,992	28.2	13,489	11.2
1955	1,494.9	39,703	26.6	17,524	11.7
1960	1,665.3	44,569	26.8	20,067	12.1
1965	2,087.6	53,343	25.6	23,242	11.1
1970	2,416.2	67,143	27.8	29,537	12.2
1971	2,484.8	68,348	27.5	30,570	12.3
1972	2,608.5	71,643	27.5	32,966	12.6
1973	2,744.1	74,282	27.1	34,840	12.7
1974	2,729.3	72,543	26.6	33,455	12.3
1975	2,695.0	70,546	26.2	32,731	12.1
1976	2,826.7	74,362	26.3	35,175	12.4
1977	2,958.6	76,289	25.8	37,122	12.5
1978	3,115.2	78,088	25.1	37,965	12.2
1979	3,192.4	78,898	24.7	37,123	11.6
1980	3,187.1	75,952	23.8	34,202	10.7
1981	3,248.8	73,989	22.8	31,931	9.8
1982	3,166.0	70,840	22.4	30,232	9.5
1983	3,277.7	70,495	21.5	30,054	9.2
1984	3,492.0	74,108	21.2	31,051	8.9
1985	3,570.0	73,867	20.7	30,852	8.6
1986E	3,660.0	75,050	20.5	31,780	8.7
Percentage change:					
1929-40	+8.9	−0.7	−9.0	+34.2	+23.1
1940-50	+55.7	+44.1	−7.2	+82.1	+16.7
1950-70	+100.2	+97.5	−1.4	+119.0	+8.9
1970-85	+47.8	+10.0	−25.5	+4.5	−29.5

E - Estimate
Source: Energy Information Administration

U.S. ENERGY CONSUMPTION BY SOURCE

	Petroleum	% of total	Natural gas	% of total	Coal	% of total	Nuclear	% of total	Hydro and other	% of total	Total
	(Quadrillion BTU)										
1973	34.840	46.9	22.512	30.3	12.971	17.5	0.910	1.2	3.049	4.1	74.282
1974	33.455	46.1	21.732	30.0	12.662	17.5	1.272	1.8	3.421	4.6	72.543
1975	32.731	46.4	19.948	28.3	12.663	17.9	1.900	2.7	3.305	4.7	70.546
1976	35.175	47.3	20.345	27.4	13.584	18.3	2.111	2.8	3.147	4.2	74.362
1977	37.122	48.7	19.931	26.1	13.922	18.2	2.702	3.5	2.612	3.5	76.289
1978	37.965	48.6	20.000	25.6	13.765	17.6	3.024	3.9	3.334	4.3	78.088
1979	37.123	47.1	20.666	26.2	15.039	19.1	2.776	3.5	3.293	4.1	78.898
1980	34.202	45.0	20.391	26.8	15.423	20.3	2.739	3.6	3.197	4.3	75.952
1981	31.931	43.2	19.926	26.9	15.908	21.5	3.008	4.1	3.216	4.3	73.989
1982	30.232	42.7	18.507	26.1	15.322	21.6	3.131	4.4	3.647	5.2	70.840
1983	30.054	42.6	17.352	24.6	15.898	22.6	3.203	4.5	3.989	5.7	70.495
1984	31.051	41.9	18.507	25.0	17.074	23.0	3.538	4.8	3.937	5.3	74.108
1985	30.852	41.8	17.813	24.1	17.487	23.7	4.144	5.6	3.572	4.8	73.867

Source: Energy Information Administration



*Major brand regular including state and federal taxes.
Source: American Petroleum Institute and Energy Information Administration

Multifuel capability has increased producing greater price competition between fuels.

What is happening in the industrial and utility sectors and, to a lesser degree, in the residential sector, is that multifuel capabilities have been installed. This enables end users to choose the lowest-cost fuel and will work toward keeping the BTU cost of competing fuels relatively close. Lower oil and natural gas prices will increase their competitive positions relative to competing fuels.

Residual fuel oil is the petroleum product that is in direct competition with the other major fuels in the industrial and utility sectors of the economy. Resid is competing directly with both coal and natural gas.

Distillate fuel oil also meets direct competition with natural gas in the residential and commercial sectors for heating.

The cost of fuels delivered to steam-electric utility plants gives a good picture of how the relative cost of competing fuels has shifted over the past several years. Coal has been, and still is, the cheapest fuel, followed by natural gas, and then resid, the most expensive. But the price differentials have changed. With limitations on new natural gas facilities and possibly some environmental limitations on coal use, there is a possibility that the lower relative cost of resid might make it an attractive alternative; particularly if substantial new investment is required to use more coal.

In 1973 the cost of heavy oil for steam-electric utility plants was 193.8% of the cost of coal, and heavy oil was 232.2% of the cost of natural gas. These relative prices moved up to heavy oil 348.2% of coal and 190.2% of natural gas in 1981. Natural gas prices were also moving up rapidly over this period. The utility plant average cost for all fossil fuels increased 373.9% from 1973 to its peak in 1981. Since 1981, heavy fuel costs have been falling. The costs of coal and natural gas slowed their rate of increase from 1981-1984 and fell slightly in 1985. For 1985, the cost of heavy oil for utilities was 257.5% of coal and 123.7% of natural gas.

Heavy oil costs had fallen 20.4% from the peak in 1981. Coal costs were up 7.6% over this period, and natural gas costs were up 22.4%. The average cost to the utility for all fuels was down 7%. Heavy fuel oil became more competitive, particularly with respect to natural gas. It is expected that these prices will converge over the forecast period.

Demand for petroleum increased 34 of 36 years between 1942 and 1978.

Demand for petroleum products increased in 1984 after five consecutive years of decline. It remained at the same level in 1985. But the five-year decline from 1978 to 1983 was unprecedented in duration. Domestic demand for petroleum products increased for 31 consecutive years from 1942 to 1973. The only downturn of any duration has been during the great depression, when demand fell for three consecutive years between 1929 and 1932.

Following the price rise in 1973-1974, demand for petroleum products fell 5.7% from 17.308 million b/d to 1973 to 16.322 million b/d in 1975. When prices then leveled, demand resumed its increase, rising for 3 more years to peak at 18.847 million b/d in 1978. Over that three-year period, 1975-1978, demand increased 2.525 b/d, 15.5%.

The second price hike put an end to the steady rise in demand for petroleum products. It had an almost immediate impact on demand. Demand fell 3.616 million b/d over the next 5 years to 15.231 million b/d in 1983. This was a drop of 19.2% and put demand back in the 1971 level—12 years earlier. Price-induced conservation was the major reason for the decline, but sluggish economic activity also contributed to the drop in petroleum demand.

Lower prices for petroleum products, and substantial economic growth, helped boost demand 3.2% in 1984 to 15.726 million b/d. Demand remained at this level in 1985 as economic growth slowed.

ENERGY CONSUMPTION—END USER SECTOR

(Quadrillion BTU)

Year	Residential and commercial	% of total	Industrial	% of total	Transportation	% of total	Total energy consumption
1973	24.14	32.5	31.54	42.5	18.60	25.0	74.28
1974	23.73	32.7	30.70	42.3	18.11	25.0	72.54
1975	23.90	33.9	28.41	40.3	18.24	25.8	70.55
1976	25.02	33.6	30.24	40.7	19.09	25.7	74.36
1977	25.38	33.2	31.09	40.8	19.81	26.0	76.29
1978	26.08	33.4	31.41	40.2	20.59	26.4	78.09
1979	25.81	32.8	32.62	41.3	20.46	25.9	78.90
1980	25.66	33.8	30.61	40.3	19.69	25.9	75.95
1981	25.24	34.1	29.25	39.5	19.50	26.4	73.99
1982	25.63	36.2	26.14	36.9	19.07	26.9	70.84
1983	25.62	36.3	25.75	36.5	19.13	27.2	70.50
1984	26.44	35.7	27.79	37.5	19.88	26.8	74.11
1985	26.82	36.3	27.04	36.6	20.01	27.1	73.87

Source: Energy Information Administration

REFINED PETROLEUM PRODUCTS SUPPLIED TO END-USE SECTORS

(Million b/d)

	Residential and commercial	% of total	Industrial	% of total	Trans.	% of total	Electric utilities	% of total	Total	% of total
1973	2.23	12.9	4.49	25.9	9.05	52.3	1.54	8.9	17.31	100.0
1974	2.04	12.3	4.30	25.8	8.83	53.0	1.48	8.9	16.65	100.0
1975	1.95	11.9	4.04	24.8	8.94	54.8	1.39	8.5	16.32	100.0
1976	2.12	12.1	4.45	25.5	9.37	53.7	1.52	8.7	17.46	100.0
1977	2.14	11.6	4.83	26.2	9.75	52.9	1.71	9.3	18.43	100.0
1978	2.07	11.0	4.88	25.9	10.15	53.8	1.75	9.3	18.85	100.0
1979	1.73	9.3	5.35	28.9	9.99	54.0	1.44	7.8	18.51	100.0
1980	1.52	8.9	4.84	28.4	9.55	56.0	1.15	6.7	17.06	100.0
1981	1.33	8.3	4.28	26.7	9.49	59.0	0.96	6.0	16.06	100.0
1982	1.24	8.1	4.06	26.5	9.31	60.9	0.69	4.5	15.30	100.0
1983	1.30	8.5	3.85	25.3	9.40	61.7	0.68	4.5	15.23	100.0
1984	1.34	8.5	4.10	26.1	9.73	61.8	0.56	3.6	15.73	100.0
1985E	1.36	8.7	4.03	25.7	9.83	62.5	0.48	3.1	15.70	100.0

Source: Energy Information Administration

EXPORTS OF REFINED PRODUCTS AND CRUDE

1,000 b/d

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Gasoline	4	2	2	1	1	2	20	10	6	10
Distillate	1	1	3	4	3	5	74	64	51	67
Residual	12	6	13	9	34	118	209	185	190	197
Lubricants	26	26	27	24	23	19	16	16	15	15
Coke	103	102	111	146	137	138	156	195	193	187
Asphalt and road oil	1	1	1	—	1	—	1	1	1	—
LPG	25	18	20	15	21	42	65	73	48	62
Other refined products	43	37	27	39	39	43	38	31	37	39
Total refined products	**215**	**193**	**204**	**238**	**259**	**367**	**579**	**575**	**541**	**577**
Crude	8	50	158	234	287	228	236	164	181	204
Total exports	**223**	**243**	**362**	**472**	**546**	**595**	**815**	**739**	**722**	**781**

Source: Energy Information Administration

Electric utility demand for petroleum fell 73.8% between 1978 and 1985.

In the U.S. economy, demand for petroleum products is down from the 1978 peak in all sectors of the economy. However, demand in the residential/commercial sector and transportation sector has been rising since 1982.

The sharpest decline has been in consumption by electric utilities. Since 1978, electric utilities have moved away from oil to coal and nuclear. Demand has dropped from 1.75 million b/d to approximately 480,000 b/d in 1985, down 73.8%. The share of total petroleum demand has fallen from 9.3% to only 3.1%. Competition from nuclear power, coal and natural gas have all reduced demand in this sector.

Industrial sector demand peaked in 1979 at about 5.3 million b/d. It fell to an estimated 4.03 million b/d in 1985, down 24.7%. The industrial sector share of total domestic demand has not changed a great amount. It was 25.9% in 1973, moved up to 28.9% in 1979 and was 25.7% in 1985.

Residential and commercial sector demand was trending down from 1973 to 1982, dropping 44.4% from 2.23 million b/d to 1.24 million b/d in 1982. This sector's share of the total fell from 12.9% to 8.1%. Conversion to natural gas and the use of natural gas for new buildings because of the price advantage was the main reason for the downward shift. Demand in this sector has been on the rise over the past three years, moving up to 1.36 million b/d in 1985, 8.7% of total demand.

Transportation sector demand in 1985 was still below the 1978 peak. But sector demand had been on the rise since 1982, and the share of total demand has been constantly increasing since 1977.

Transportation demand hit 10.15 million b/d in 1978, but then fell 8.3% to 9.31 million b/d in 1982. The reasons for the decline were improved efficiency of motor vehicles, and cost consciousness and conservation by drivers.

Demand moved back up 5.6% to 9.83 million b/d in 1985. The transportation sector's share of total petroleum demand has moved up from 52.9% in 1977 to 62.5% in 1985. Petroleum products do not have major fuels competition in the transportation sector.

Past forecasts ignored price elasticity of demand for petroleum products.

One of the things that was underestimated or ignored in some past outlooks was the price elasticity of demand for petroleum products. That is, the change in demand relative to a change in price.

There is no way to isolate demand for petroleum products and measure only the response due to price change, but the sharp price hikes, particularly in the late 1970s, enable the calculation of a rough estimate. Over the past few years, the elasticity of demand for all petroleum products has been approximately 0.1. For every 10% increase in the price, demand fell 1%. This varied from product to product.

Although this would indicate that demand was relatively "inelastic," it does show that, contrary to some preconceived notions, demand would fall if the price increase was too great.

From 1970 to 1981, the composite U.S. refiner acquisition cost of crude oil increased 936%, from $3.40/bbl to $35.24/bbl. This is an increase of $31.74/bbl and an annual average relative increase of 2.3%/year. Crude oil prices obviously determine product prices, which also skyrocketed. These massive price increases, far surpassing the overall rate of inflation, had a tremendous impact on investment and consumption decisions and resulted in a reduction in demand for oil products.

Since 1981, the price of crude has been falling. The composite U.S. refiner acquisition cost for 1984 was $28.63/bbl. This was a drop of

Demand moved up 1.7% for every 10% drop in price.

18.8% from the 1981 average price. Demand rebounded in 1984 increasing 3.2%. This is a roughly 1.7% increase in demand for every 10% decrease in price. There are obviously many factors affecting demand, but relative price is one. However, it will take a longer period to determine if demand elasticity is close to this estimate.

In 1985 the refiner acquisition cost fell an additional 6.5%, but demand remained at the same level as 1984. This would indicate an even lower elasticity of demand, closer to 1% change for every 10% shift in price.

The impact of price on motor gasoline demand has not been as great as some other petroleum products, but it has been significant. Demand peaked in 1978 at 7.412 million b/d and then fell 11.8% to 6.539 million b/d in 1982. The price of gasoline obviously influenced driving behavior, reducing the number of miles driven and changing attitudes about type of vehicles. Drivers cut out a lot of wasteful discretionary driving and also opted to purchase more fuel-efficient vehicles. Gasoline demand fell about 1% for every 10% increase in price. The major impact of the rapid increase in price was the federal government-mandated vehicle fuel efficiency standards. This forced improvement in vehicle fuel-efficiency.

But as prices have fallen, demand has increased. Motor gasoline demand for 1985 was 6.831 million b/d, up 4.5% from 1982. The average pump price for all types of motor gasoline was $1.196 per gallon for 1985, down 11.6% from $1.353 per gallon in 1981.

Gains in auto fuel efficiency will offset increased consumption due to lower gasoline prices.

The level of demand for motor gasoline is affected by a number of competing factors: vehicle fuel efficiency, average miles driven per vehicle, and total number of vehicles in the fleet. The total number of vehicles registered has been steadily rising. It had reached 168.6 million in 1984, up 6.4% from 1981, the year of peak gasoline prices. Car registrations are up 5.3%, at 129.1 million. Miles traveled per car in 1981 were 9,809, up 9% from 9,002 in 1981. Miles driven per car peaked in 1972 at 10,184.

These factors are offset by the improved vehicle efficiency and declining fuel consumption per vehicle. The average miles per gallon of gasoline was up to 16.94 miles in 1984. This is up 9% from 1981 and up 29.3% from the low of 13.1 miles per gallon in 1973. The average fuel consumed per car was 579 gallons in 1984, compared to 763 gallons in 1973.

The once-expected impact of new diesel-powered cars is diminishing. Between 1983 and 1984, sales of diesel-fueled automobiles declined 21.5%, and the largest auto manufacturer, General Motors, has begun to eliminate diesel-powered vehicles from their passenger car line.

Demand for distillate fuel oil also peaked in 1978, at 3.432 million b/d. It then fell sharply, 22.2%, to 2.671 million b/d in 1982. Between 1978 and 1981, the price of home heating oil increased 165.1% from 38.7¢/gal to $1.026/gal. This resulted in a sharp shift to natural gas for heating and a sharp cut in fuel oil used. During the decline, distillate demand fell about 1.25% for every 10% increase in price. Prices dropped since 1981, and demand responded. Distillate demand moved up over the last three years, increasing 7.4% to 2.868 million b/d in 1985.

Highway and rail transport, and residential and commercial heating are the major uses for distillate. Residential and commercial consumption was down from 1.014 million b/d in 1979 to 704,000 b/d in 1984, a drop of 30.6%. The number of oil burners in use fell by over 2 million and the fuel used per burner fell over 30%.

Demand for distillate stimulated by the recent drop in price.

The drop in price in the last couple of years will stimulate demand. Home heating oil has become competitive with natural gas in some areas and has slowed conversions. Heating oil demand has actually increased 8.4% from 1982 to 1984.

Highway diesel demand is closely related to economic activity. Diesel consumption did fall sharply, 4.5% in 1980, but it has been on the rise since moving up to 1.205 million b/d in 1984, an increase of 17.2% from 1980. Diesel demand is expected to continue to rise as long as the economy continues to expand.

Over half of the difference between the level of petroleum demand at the peak in 1978 and that in 1985 can be attributed to the drop in demand for residual fuel oil. Total demand in 1984 was 3.121 million b/d below the 1978 peak. Demand for residual fuel oil in 1985 was 1.202 million b/d, down 1.821 million b/d from the 1978 level of 3.023 million b/d. This accounts for 58.3% of the lower level of petroleum demand. Resid demand in 1985 was down 60.9% from the peak resid demand in 1977, a drop of 1.869 million b/d.

The shift by electric utilities from residual fuel oil to cheaper fuel sources such as coal, nuclear and hydro, was the major reason for the drop in resid demand. In 1978, almost half of the resid consumed was by the utility sector, 48.3% or 1,461 million b/d. By 1985, utility sector demand had fallen 71% to an estimated 424,000 b/d. Industrial demand was also down sharply, falling from 622,000 b/d in 1978 to an estimated 182,000 b/d in 1985. The resid demand response to the price increases was a lot greater than for some other products. With more competition from competing fuels, resid demand tends to be more "elastic." Resid demand fell about 3% for every 10% increase in price.

Demand for resid is a key to future total petroleum demand.

Demand for resid may be one of the keys to the level of future overall demand for petroleum. Prices for resid have fallen sharply, and it has improved its competitive position relative to other fuels. If prices remain competitive, there could be a substantial improvement in demand.

Outlook

The combination of lower oil prices, lower petroleum product prices and increased economic activity will give a substantial boost to U.S. petroleum demand over the forecast period 1986-1991.

But demand is very dependent upon the level of economic activity, and will tend to follow the pattern of economic growth over this period. Energy and economic activity are closely interrelated, and the lower energy costs will help boost the rate of economic growth.

The economy will grow at a rate of about 2.6% per year over the forecast period.

The rate of economic growth will not be spectacular over the forecast period, with the economy expanding at an average annual rate of about 2.6%. The economy will not be expanding at a level close to its potential, but also is not expected to slide into a recession during this period. Lower energy costs and lower interest rates should boost investment and productivity, but potential growth will be moderate due to the overhanging burden of huge government, corporate and personal consumer debt. In fact, the economic growth rate will probably be slowed substantially during the forecast period, as attention is diverted from productive activity to debt management.

It is expected that economic growth wil be somewhat more vigorous in 1986, with GNP up 2.5%. Spurred by much-lower energy costs, the economy is expected to grow 3% in 1987. The lower energy costs should help to prevent a recession during the forecast period, but the business cycle is not completely dead. Expectations are that the rate of growth will slow in 1988 and 1989 due to the heavy burden of government, corporate and personal debt. Economic growth will slow to about 2% in 1989. If the debt problem can be dealt with effectively, then the economy should rebound and economic growth will pick up toward the end of the forecast period. GNP will be moving up at a 2.7% or greater annual rate in 1990 and 1991. Lower energy costs, lower interest rates and increased productivity could combine to give the economy a very vigorous boost in the latter 1980's, but this is dependent upon a resolution of the hefty debt problem. Real GNP should be up 16.5 to 20% by 1991.

Because of the much lower cost of energy, it is expected that energy consumption will move up at a much faster rate relative to GNP than in recent years. Total energy is expected to increase at an average annual rate of about 1.4%, slightly more than half of the growth rate of GNP.

Energy consumption will increase faster than in recent years at 1.4% per year.

Energy efficiency improvements would continue, but they will be more than offset by the increase in energy consumption to support economic growth. With much lower-cost energy, there will be less conservation and a larger proportion of energy used in production or providing services.

The trend in the relationship of energy to real GNP will continue down the path of increased energy efficiency. Energy required per dollar of real GNP will drop to 19,300 BTU by 1991, a further 5.9% improvement in energy efficiency.

Total energy demand will increase 7% over the forecast period. Energy from petroleum is expected to increase at about the same rate as overall energy, moving up 6.9%. Lower prices will make petroleum very competitive with other energy sources.

Energy from nuclear power is expected to increase 33.9% over the period. This is growth from new plants already under construction and increased output from existing facilities. Nuclear will have 7.5% of total energy by 1991. There will be little growth in nuclear energy beyond the forecast period.

Energy from coal will continue to move up slowly over the five-year period. Increased competition from petroleum will slow growth in coal. But the market share will increase to 24% in 1991. Coal will take over as the second leading fuel source in 1986 and retain this position.

Petroleum will maintain its market share of 42.3% throughout the forecast period, but natural gas will lose market share. Energy from natural gas will fall 1.8% over the forecast period and market share will fall to 21.3%. Government regulations and restrictions, as well as the recent slow-down in exploration, will prevent natural gas from reaching its potential during this period.

The combination of petroleum and natural gas will provide 63.6% of total energy in 1991. It is expected that the cost of competing fuels will continue to converge over the 1986-1991 period. Relative share of the market will depend upon the fuel that is most cost-effective.

The combination of lower oil prices and continued economic growth will stimulate increased demand for petroleum products over the forecast period. Total domestic demand will increase 6.9% over the forecast period to 17.3 million b/d, an increase of 1.11 b/d.

Motor gasoline demand will move up over the forecast period, but not as rapidly as overall demand. Demand for gasoline will increase 3.4% to 7.23 million b/d in 1981.

Petroleum and natural gas will provide 63.3% of total energy in 1991.

The total vehicle fleet is expected to increase as well as the miles driven annually per vehicle, but this will be offset by the improvement in vehicle fuel efficiency. Gasoline prices will move back up over the forecast period, increasing about 36.9%, but increased economic activity will give the driving segment of the population more discretionary income to spend on travel.

Some of the increased income spent on travel will also increase air travel and demand for jet fuel. With increased business travel, jet fuel demand will increase 11.5% to 1.46 million b/d by 1991.

The upswing in the economy will also stimulate demand for distillates, particularly diesel fuel for highway transport. There is a close relationship between distillate demand, particularly for transport, and economic growth. Distillate demand will move up 9% to 3.22 million b/d in 1991.

Resid demand will rebound due to the lower price.

Demand for resid may be one of the keys to the level of future overall demand for petroleum products. Prices for resid have been falling sharply. This has stopped the sharp decline in resid demand. Resid demand has already started to move up, and it is expected to continue throughout the forecast period. Resid demand will increase 15.5% to 1.45 million b/d in 1991.

With limitations on expanding nuclear power, and some potential limits on coal due to acid rain, resid and natural gas may be the fuels for power generation in the 1990's. Due to lower actual and real prices, demand for other petroleum products is also expected to increase over the forecast period.

Demand for other petroleum products is expected to move up along with increased economic activity. One factor that is holding back a major resurgence in oil demand is the long-range price expectations. Since increased demand of any significant amount must be met by OPEC production, potential customers are reluctant to commit to capital equipment that requires oil consumption. Therefore, the return to oil will be moderate and somewhat cautious over the forecast period. However if prices remain at the low levels of 1986, there could be a much greater increase in petroleum demand over the 1986-1991 period.

THE OUTLOOK — U.S. DEMAND

	1986	1987	1988	1989	1990	1991	Change 1986 to 1991	% change 1986 to 1991
ENERGY DEMAND (trillion BTU)								
Petroleum	31,780	32,420	32,820	33,165	33,565	33,960	+ 2,180	+ 6.9
Natural gas	17,410	17,400	17,355	17,110	17,105	17,100	− 310	− 1.8
Coal	17,610	17,945	18,235	18,565	18,890	19,240	+ 1,630	+ 9.3
Nuclear	4,480	4,875	5,175	5,485	5,760	6,000	+ 1,520	+ 33.9
Hydro and other	3,770	3,835	3,885	3,920	3,940	3,990	+ 220	+ 5.8
Total	**75,050**	**76,475**	**77,470**	**78,245**	**79,260**	**80,290**	**+ 5,240**	**+ 7.0**
PETROLEUM DEMAND (thousand barrels/day)								
Motor gasoline	6,990	7,060	7,100	7,135	7,180	7,230	+ 240	+ 3.4
Jet fuel	1,310	1,365	1,390	1,410	1,435	1,460	+ 150	+ 11.5
Distillate	2,955	3,035	3,090	3,125	3,175	3,220	+ 265	+ 9.0
Residual fuel oil	1,255	1,300	1,340	1,385	1,420	1,450	+ 195	+ 15.5
Ethane and LPG	1,615	1,650	1,670	1,690	1,710	1,730	+ 115	+ 7.1
Other products	2,065	2,105	2,130	2,150	2,180	2,210	+ 145	+ 7.0
Total	**16,190**	**16,515**	**16,720**	**16,895**	**17,100**	**17,300**	**+ 1,110**	**+ 6.9**
CRUDE OIL PRICE (Av. U.S. wellhead) ($/barrel)	13.50	15.50	16.50	17.50	19.50	21.50	+ 8.00	+ 59.3
MOTOR GASOLINE PRICE (average all types) ($/gallon)	0.895	0.975	1.015	1.060	1.140	1.225	+ 0.330	+ 36.9

U.S. OUTLOOK—SUPPLY

U.S. OUTLOOK—SUPPLY

THE SHARP DECLINE in prices is expected to have a major impact on U.S. domestic supply over the forecast period. A substantial volume of U.S. production is relatively high-cost production. This high-cost production is more sensitive to this a drop in the price of crude than production in some other areas of the world.

Over the past few years, U.S. supply was more predictable than demand. Since domestic demand far exceeds available domestic production, there has not been a problem selling domestic output. So availability of domestic crude is dependent upon the price of crude oil and the related cost of production. With the price relatively high, U.S. production was maintained at a high level, with little relative year-to-year change. Actually, U.S. supply had been moving up slowly. The U.S. industry had been able to raise the necessary capital to exploit the available hydrocarbons.

In the past, the supply response to price changes had been slower than the demand response. This huge drop in prices, however, will result in a much faster domestic supply response as marginal uneconomic wells are shut in and new exploration activity is curtailed.

Demand for petroleum products can only be met by domestic liquids production plus imports of crude and products. In the short run, crude and product stocks can help satisfy demand, but this is only temporary. Since U.S. domestic production is unable to support total domestic demand for petroleum products, a substantial volume of imports is required. Imports are generally the swing supply source, and will vary with demand.

Over the forecast period, imports will be increasing rapidly. Imports will have to fill in for both increasing demand and declining domestic production.

Review

U.S. domestic crude and condensate production has gone through several shifts in direction over the past 15 years. Looking at the last several years, U.S. crude and condensate production declined from 9.477 million b/d in 1972 to 8.132 million b/d in 1976, a drop of 1.345 million b/d, or 14.2%. With the development of the Alaskan North Slope, production jumped to 8.707 million b/d in 1978, but then started on the decline again, falling to 8.572 million b/d in 1981.

The high domestic crude prices stimulated U.S. exploration and production.

The high domestic crude prices resulting from the OPEC price increase of 1979–1981 stimulated domestic exploration and development. At these higher prices, production from many marginal low-volume U.S. wells became profitable. Production of crude oil and condensate increased for the next four consecutive years, reaching 8.971 million b/d in 1985. The higher prices had helped boost U.S. production 4.7%, up 399,000 b/d.

The drilling and development surge over the 1979–1982 period helped slow the expected decline rate in the lower 48 states, and increased production in Alaska has boosted total U.S. domestic output. This increase in U.S. domestic production was a direct result of the increase in the price of crude oil. This rapid increase in price

U.S. LIQUIDS PRODUCTION AND RESERVES

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	% change 78/73	% change 85/78	% change 85/73
							(1,000 b/d)									
Crude & condensate production:																
California	921	884	883	892	958	935	966	975	1,055	1,100	1,109	1,126	1,161	1.5	24.2	26.1
Kansas	181	169	162	160	158	153	156	164	180	193	196	207	207	-15.5	35.3	14.4
Louisiana	2,278	2,018	1,796	1,686	1,542	1,460	1,355	1,283	1,231	1,256	1,314	1,408	1,392	-35.9	-4.7	-38.9
New Mexico	276	267	259	251	239	230	217	206	196	195	206	217	215	-16.7	-6.5	-22.1
North Dakota	55	54	56	59	64	64	84	110	124	130	139	144	139	16.4	117.2	152.7
Oklahoma	524	487	447	441	428	418	393	410	422	435	435	460	446	-20.2	6.7	-14.9
Texas	3,546	3,454	3,347	3,251	3,117	2,948	2,776	2,672	2,589	2,535	2,473	2,472	2,435	-16.9	-17.4	-31.3
Wyoming	389	386	349	319	306	376	361	345	358	324	324	340	352	-3.3	-6.4	-9.5
Others	839	852	872	887	904	872	843	815	808	785	778	783	799	3.9	-8.4	-4.8
Total Lower 48	**9,009**	**8,571**	**8,171**	**7,946**	**7,716**	**7,456**	**7,151**	**6,980**	**6,963**	**6,953**	**6,974**	**7,157**	**7,146**	**-17.2**	**-4.2**	**-20.7**
Alaska	199	193	191	173	463	1,245	1,402	1,617	1,609	1,696	1,714	1,722	1,825	525.6	46.6	817.1
Total U.S.	**9,208**	**8,764**	**8,362**	**8,119**	**8,179**	**8,701**	**8,553**	**8,597**	**8,572**	**8,649**	**8,688**	**8,879**	**8,971**	**-5.5**	**3.1**	**-2.6**
NGL production:																
Total U.S.	1,738	1,688	1,633	1,603	1,618	1,567	1,584	1,573	1,609	1,550	1,559	1,630	1,609	-9.8	2.7	-7.4
Total liquids production:																
Total U.S.	10,946	10,452	9,995	9,722	9,797	10,268	10,137	10,170	10,181	10,199	10,247	10,509	10,580	-6.2	3.0	-3.3
							(Million bbl)									
Total U.S. Reserves																
Crude	35,299	34,250	32,682	30,942	29,486	27,804	27,051	29,805	29,426	27,858	27,735	28,446	28,000	-21.2	0.7	-20.7
NGL	6,455	6,350	6,268	6,402	5,994	5,326	5,655	6,728	7,068	7,221	7,901	7,643	7,625	-8.2	28.7	18.1
Total	**41,754**	**40,600**	**38,950**	**37,344**	**35,480**	**33,730**	**32,706**	**36,533**	**36.494**	**35,079**	**35,636**	**36,089**	**35,625**	**-19.2**	**5.6**	**-14.7**
							(Years)									
Reserves/production ratio:																
Crude	10.50	10.71	10.71	10.44	9.88	8.75	8.67	9.50	9.40	8.82	8.75	8.75	8.55			
NGL	10.18	10.31	10.52	10.94	10.15	10.36	9.78	11.72	12.04	12.76	13.89	12.81	12.98			
Total	**10.45**	**10.64**	**10.68**	**10.52**	**9.92**	**9.00**	**8.84**	**9.84**	**9.82**	**9.42**	**9.53**	**9.38**	**9.23**			

Source: American Petroleum Institute; Energy Information Administration

CRUDE AND PRODUCT IMPORTS: RELATION TO DEMAND

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	% change 78/73	% change 85/78
							(1,000 b/d)								
Imports:															
Crude*	3,244	3,477	4,105	5,287	6,594	6,195	6,452	5,219	4,141	3,323	3,096	3,229	3,098	+ 91.0	-50.0
Products	3,012	2,635	1,951	2,026	2,193	2,008	1,937	1,646	1,599	1,625	1,722	2,011	1,830	- 33.3	- 8.9
Total	**6,256**	**6,112**	**6,056**	**7,313**	**8,787**	**8,203**	**8,389**	**6,865**	**5,740**	**4,948**	**4,818**	**5,240**	**4,928**	**+ 31.1**	**-39.9**
Domestic demand	17,308	16,653	16,322	17,461	18,431	18,847	18,513	17,056	16,058	15,296	15,231	15,726	15,697	+ 8.9	-16.7
Dependency ratio:															
Imports/demand	36.2	36.7	37.1	41.9	47.7	43.5	45.3	40.3	35.8	32.4	31.6	33.3	31.4		

* Excludes imports for Strategic Petroleum Reserve

Source: Energy Information Administration

stimulated domestic exploration and drilling and encouraged the development of previously uneconomic reserves.

The decline in lower 48 crude production was reversed due to the drilling boom.

In the last several years, declining output in the lower 48 states has been offset by increased production from Alaska. Lower 48 production fell from 9.275 b/d in 1972 to 6.953 million b/d in 1982, a drop of 2.322 million b/d, down 25%.

Effects of the drilling boom began to show up in 1983, as lower 48 output moved up marginally to 6.974 million b/d. This was an increase of 21,000 b/d; only 0.3%, but a complete reversal of the expected constant rate of decline. Lower 48 production continued to move up in 1984 with estimated output of 7.152 million b/d. Production in 1985 was sustained at close to this level with 7.146 million b/d. The Alaskan North Slope was developed in 1977 and 1978. The first full year of North Slope production, 1978, Alaskan output was 1.229 million b/d. Production from the North Slope has been moving up steadily since then. Average Alaskan output for 1985 was 1.825 million b/d. This is an increase of 596,000 b/d, or 48.5%, since the year of initial production.

NGL production has not varied greatly over the past several years. Output varies with the relative economics associated with gas liquids products. It is dependent upon the cost of extraction versus the market value of the products. Producers have the flexibility of varying the extraction rate of liquids from gas, dependent upon the economics.

Total domestic liquids production moved up from 9.774 million b/d in 1976 to 10.636 million b/d in 1985.

From 1975–1980, NGL output averaged 1.596 million b/d. Over the past five years, 1981–985, output has averaged 1.591 million b/d. Output hit a low of 1.55 million b/d in 1982, but was up to 1.63 million b/d in 1984 and 1.609 million b/d in 1985.

Total domestic liquids production has also increased in recent years. Output dropped to 9.774 million b/d in 1976. It had increased 8.8% by 1985 to 10.636 million b/d. This was an additional 862,000 b/d of domestic production that helped reduce dependence on imports.

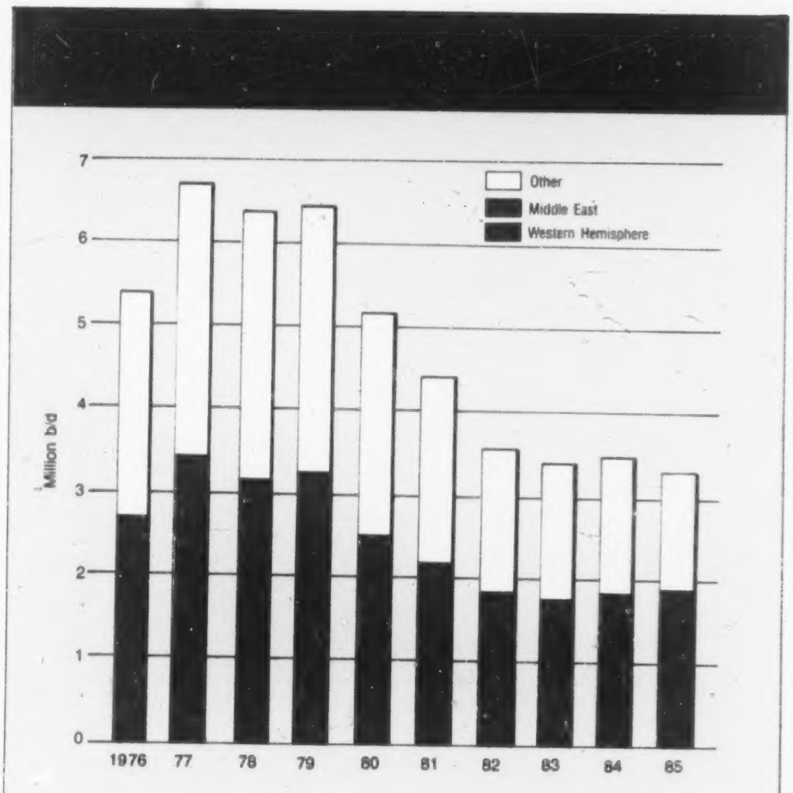
Key indicators of future potential domestic crude oil production are the level of reserves and the ratio of proven reserves to current production. Total U.S. liquids reserves at the end of 1985 were down 14.7% from 1973, but end 1985 reserves were up 5.6% from 1978. The drilling boom in the U.S. from 1979–1982, that followed the sharp increase in prices, slowed the expected decline in U.S. reserves and temporarily reversed the long-run decline.

The reserves-production ratio was 10.68 years in 1975. This fell sharply to 8.84 years in 1979 before the drilling boom. The ratio jumped to 9.84 years in 1980 and 9.82 years in 1981, but it has been declining recently as production has increased, falling to 9.23 years in 1985. Replacing reserves is essential to the long-term viability of U.S. domestic industry and to U.S. energy security, but it is apparent that a massive exploration and drilling effort is essential to accomplish this.

Since U.S. liquids production is not sufficient to meet U.S. demand, imports are required to fill the gap. Imports are the swing source of petroleum and vary with the level of the gap between domestic demand and domestic production.

Imports fell from 8.787 million b/d in 1977 to 4.817 b/d in 1983.

Total imports peaked in 1977 at 8.787 million b/d. As demand fell, imports were reduced, rather than domestic production. Imports fell to 4.818 million b/d in 1983, down 3.969 million b/d, 45.2%. Demand fell 3.616 million b/d over the same period, 1978 through 1983. All of this decline in demand resulted in a drop in imports. In addition, increased domestic production and stock adjustments backed out an additional 353,000 b/d in imports.



*Includes imported crude for the Strategic Petroleum Reserve.
Source: Energy Information Administration

SPOT MARKET VOLUMES

Year	U.S. Imports (Thousand barrels per day) Total industry imports	Fixed price contract	Spot market
1975	6.056	5.871	185
1976	7.313	7.018	295
1977	8.786	8.346	440
1978	8.201	7.751	450
1979	8.389	7.884	505
1980	6.866	6.386	480
1981	5.740	5.165	575
1982	4.948	3.958	990
1983	4.817	2.887	1.930
1984	5.240	2.358	2.882
1985	4.927	985	3.942

Note: Spot market volumes include for 1983 and 1984 contract volumes where the price is directly related to spot market prices and fluctuates with the spot market prices. This might be more aptly labeled "volumes traded on the spot market and at market related prices."

Source: Energy Information Administration and Author's estimates

STOCK LEVELS AND DAYS' SUPPLY

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Stocks: (1,000 bbl)												
Crude oil*	265,020	271,354	285,471	339,813	309,421	339,080	358,166	363,464	349,730	343,850	345,376	320,892
Products	856,096	855,537	810,417	947,479	896,003	911,784	926,262	889,843	786,367	730,698	760,346	704,561
Total	**1,121,116**	**1,126,891**	**1,095,889**	**1,287,292**	**1,205,424**	**1,250,864**	**1,284,482**	**1,253,307**	**1,136,097**	**1,074,548**	**1,105,722**	**1,025,453**
SPR†	—	—	—	7,540	58,798	117,687	123,938	230,341	293,827	379,089	450,505	493,316
Demand: (1,000 b/d)												
Products supplied	16,653	16,322	17,461	18,431	18,847	18,513	17,056	16,058	15,296	15,231	15,726	15,697
Days supply:												
Product stocks	51.41	52.42	46.41	51.41	47.54	49.25	54.31	55.41	51.41	47.97	48.35	44.89
Total stocks	**67.32**	**69.04**	**62.76**	**69.84**	**63.96**	**67.57**	**75.31**	**78.04**	**74.27**	**70.55**	**70.31**	**65.33**

*Excluding SPR. †Strategic Petroleum Reserve.

Source: Energy Information Administration

Most of the decline was in crude oil imports, which fell 3.498 million b/d, from 6.594 million b/d in 1977 to 3.096 million b/d in 1983, a drop of 53%. Product imports fell 471,000 b/d, 21.5%, from 2.193 million b/d to 1.722 million b/d in 1983.

Total imports jumped up in 1984 to 5.24 million b/d, but slipped again in 1985 to 4.928 million b/d. Increased domestic production and a drop in crude and product stocks in 1985 enabled a reduction in imports. But stock levels have been drawn down to a minimum level and any future increase in demand will undoubtedly be met by increased imports.

Product imports actually hit bottom in 1981 at 1.599 million b/d. They then moved up substantially between 1981 and 1984, increasing 25.8% to 2.011 million b/d. Product imports fell to 1.83 million b/d in 1985, primarily due to a reduction in production stock that added 153,000 b/d to supply in 1985.

With excess domestic refining capacity, domestic refiners should have more incentive to import crude, rather than products. This would enable refiners to increase crude runs and lower unit costs. With the pattern of demand relatively uncertain, crude imports offer refiners additional flexibility. They can change yield patterns as required by demand.

But with excess refining capacity worldwide, products are available at low prices, making product imports economically attractive, and flexibility can be retained by simply importing the product required. As additional export refineries come on stream in the Middle East, and U.S. import requirements increase, product imports are expected to move up.

Import dependency dropped sharply from 1977 to 1983. Total imports as a percentage of domestic demand has risen from 29.1% in 1972 to a peak of 47.7% in 1977. With declining imports, this ratio fell to 31.6% in 1983. The rebound in imports in 1984 pushed it back up to 33.3%. With the drop in imports in 1985, the dependency ratio fell to 31.4%, but the ratio will climb over the forecast period as demand moves up.

Import dependency peaked in 1977 at 47.7% and then fell to 31.4% in 1985.

U.S. vulnerability to a supply disruption was reduced by a shift in the source of imports. the source of imports was shifted away from some of the more volatile areas. Crude imports from the Persian Gulf countries were reduced substantially, falling from 2.495 million b/d in 1977 to 245,000 b/d in 1985. Imports from OPEC countries fell 4.331 million b/d, from 5.643 million b/d in 1977 to only 1.312 million b/d in 1985. The share of U.S. crude imports from OPEC countries fell from 85.7% in 1976 to 41% in 1985.

Non-OPEC crude imports to the U.S. moved up from 972,000 b/d in 1977 to 1.889 million b/d in 1985. Mexico was the leading source of U.S. imported crude in 1985, supplying 715,000 b/d. Canada was second, supplying 468,000 b/d. Venezuela provided 305,000 b/d, Indonesia 292,000 b/d, Nigeria 280,000 b/d and the United Kingdom 278,000 b/d.

The share of U.S. crude imports from OPEC fell from 85.7% in 1976 to 41% in 1985.

Stocks of petroleum products and crude oil are another source of supply. Total crude and product stocks, excluding stocks for the Strategic Petroleum Reserve (SPR), fell 210 million bbl year-end 1980 to year-end 1983. This added an average 192,000 b/d to available supply over that three-year period. Stocks went up marginally, 30 million bbl, in 1984 as demand increased, but were reduced again in 1985 as refiners cut costs. Stocks fell an additional 80 million bbl, and at year-end 1985 were down 259 million barrels from year-end 1980. This had added 142,000 b/d to supply over these five

CRUDE IMPORTS BY COUNTRY OF ORIGIN

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
	(1,000 b/d)									
Eastern Hemisphere:										
Algeria	409	544	634	608	457	261	90	176	194	84
Angola	7	17	6	39	37	45	42	71	85	104
Egypt	17	36	20	55	31	33	40	25	10	3
Gabon	27	35	38	42	25	35	40	59	57	51
Libya	445	704	638	642	549	317	23	—	—	—
Nigeria	1,016	1,130	910	1,069	843	611	510	301	207	280
Other Africa*	42	34	30	42	62	32	30	48	65	62
Total Africa	**1,963**	**2,500**	**2,276**	**2,497**	**2,004**	**1,334**	**775**	**680**	**618**	**584**
Kuwait	1	42	5	5	27	—	2	7	24	4
Oman	30	74	61	37	24	24	22	34	10	2
Qatar	24	67	64	31	22	7	7	—	4	—
Saudi Arabia	1,225	1,373	1,142	1,347	1,254	1,112	530	321	309	132
United Arab Emirates	255	333	385	281	173	77	81	18	90	35
Other Middle East*	331	606	623	395	38	6	38	58	23	72
Total Middle East	**1,866**	**2,495**	**2,280**	**2,096**	**1,538**	**1,226**	**680**	**438**	**460**	**245**
Indonesia	539	507	533	380	315	318	226	315	304	292
Malaysia	16	55	37	55	61	33	18	3	—	1
Other Far East*	—	—	—	—	1	—	11	7	40	56
Total Far East	**555**	**562**	**570**	**435**	**377**	**351**	**255**	**325**	**344**	**349**
Norway	35	48	104	75	144	114	102	65	112	31
United Kingdom	13	97	169	197	174	369	441	365	378	278
Other Europe*	1	5	10	8	—	—	—	3	3	1
Total Europe	**49**	**150**	**275**	**280**	**318**	**483**	**543**	**433**	**493**	**310**
Other Eastern Hemisphere†	2	8	8	3	—	37	54	91	120	53
Total Eastern Hemisphere	**4,435**	**5,715**	**5,409**	**5,311**	**4,237**	**3,431**	**2,307**	**1,967**	**2,035**	**1,541**
Western Hemisphere:										
Brazil	—	—	—	—	1	14	19	2	—	—
Ecuador	51	55	38	30	17	38	22	56	47	56
Mexico	87	177	316	436	508	469	645	766	658	715
Peru	—	—	18	40	41	30	21	8	1	12
Trinidad-Tobago	—	—	—	—	115	102	92	83	87	98
Venezuela	241	250	181	293	156	147	155	164	253	305
Other Latin America*	—	1	2	—	3	—	—	4	1	0
Total Latin America	**379**	**483**	**555**	**799**	**841**	**800**	**964**	**1,083**	**1,047**	**1,186**
Canada	372	279	248	271	200	164	214	274	341	468
Other Western Hemisphere†	115	138	144	124	—	1	3	5	3	6
Total Western Hemisphere	**866**	**900**	**947**	**1,194**	**1,041**	**965**	**1,181**	**1,362**	**1,391**	**1,660**
Total Crude Imports	5,301	6,615	6,356	6,505	5,278	4,396	3,488	3,329	3,426	3,201
Less: SPR Imports	—	20	162	67	44	256	165	234	197	118
Crude Imports (ex. SPR)	5,301	6,595	6,194	6,438	5,234	4,140	3,323	3,095	3,229	3,083
OPEC Imports	4,545	5,643	5,184	5,112	3,864	2,922	1,734	1,477	1,512	1,312
% OPEC Imports	85.7%	85.3%	81.6%	78.6%	73.2%	66.5%	49.7%	44.4%	44.1%	41.0%

*May include data on countries listed specifically but for which no individual data are reported

†Includes data which could not be broken down by country or continent

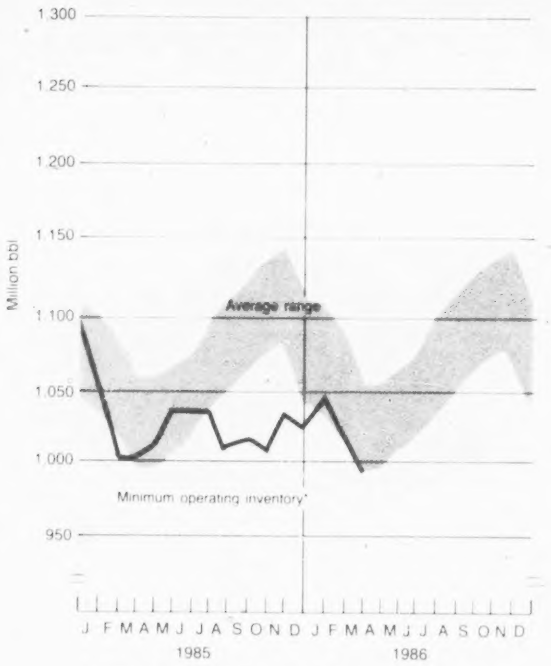
Source: Energy Information Administration

NEW YORK MERCANTILE EXCHANGE

Total annual contract volumes
Thousand contracts
(Million barrels)

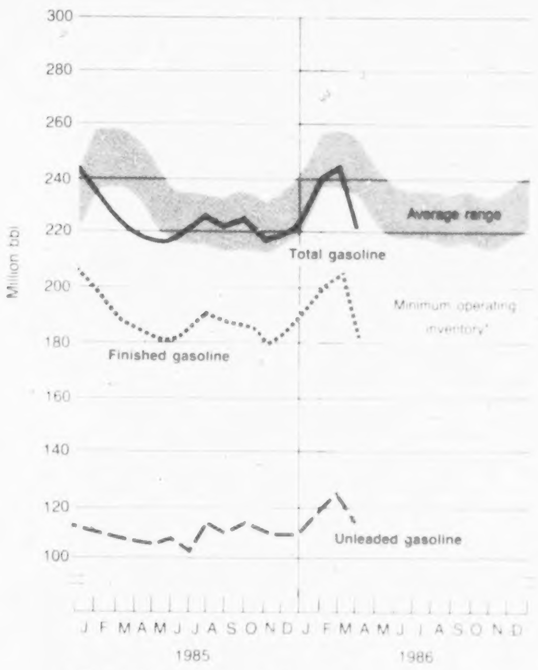
Year	Total oils	Crude oil	Heating oil	Leaded gasoline	Unleaded gasoline
1978	50	—	50	—	—
1979	100	—	100	—	—
1980	240	—	240	—	—
1981	1,010	—	950	60	—
1982	1,850	—	1,725	125	—
1983	2,625	350	1,850	425	—
1984	4,589	1,840	2,092	654	3
1985	6,989	3,981	2,208	667	133

Crude oil & pet. prod.



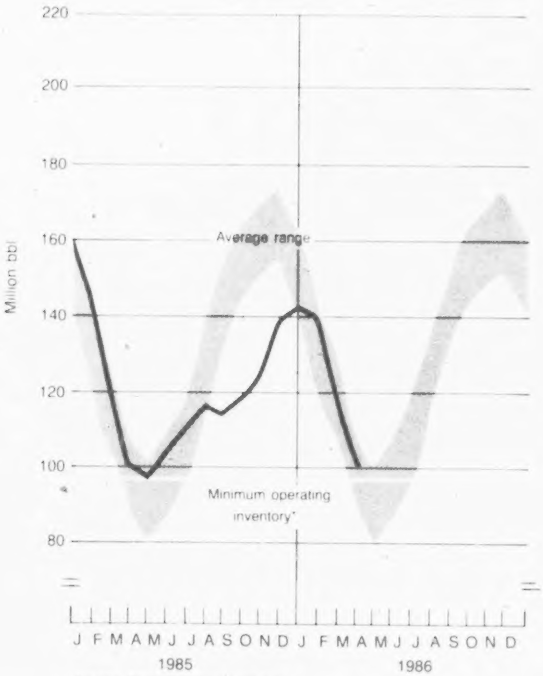
*Excludes stocks for Strategic Petroleum Reserve
Source: Energy Information Administration

Motor gasoline



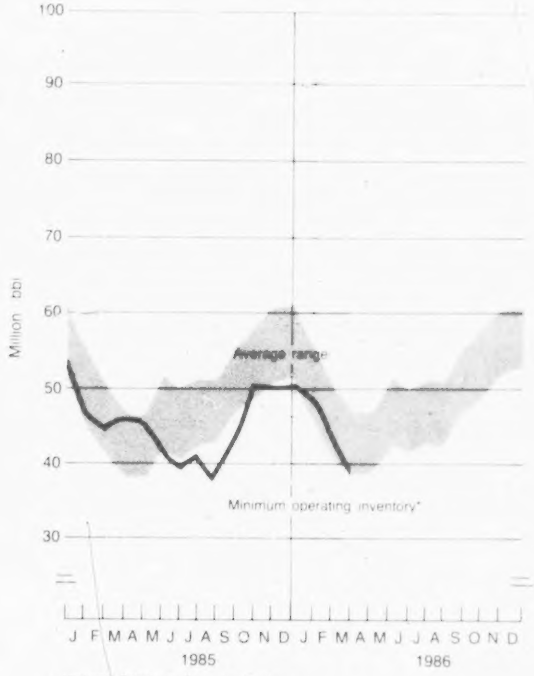
*National Petroleum Council estimate
Source: Energy Information Administration

Distillate fuel oil



*National Petroleum Council estimate
Source: Energy Information Administration

Residual fuel oil



*National Petroleum Council estimate
Source: Energy Information Administration

years. The U.S. Energy Information Administration has developed a system of tracking stocks and determining their adequacy. The system is based on historical stock levels and indicates the historical average range of product and crude stocks and the minimum operating inventory. Theoretically, if stocks fall below the minimum level, there is a danger of supply disruption. However, recently stocks for a number of products have fallen below the average range, and below, or close to, minimum operating levels. It appears that the industry is adjusting so rapidly to reduced demand levels that some of these measurements are no longer totally valid. The EIA will probably be adjusting these indicators to correspond to current industry conditions. As refining capacity is reduced and distribution networks altered, the minimum operating inventory is also reduced. The average range will be adjusted downward to reflect the lower level of demand.

The industry reduced stock levels as carrying costs increased.

Prior to 1981, the industry was willing to build up stocks as a buffer against a potential supply disruption. There was also uncertainty about the extent of the drop in demand. Stocks were maintained at a relatively high level, in anticipation of demand going back up.

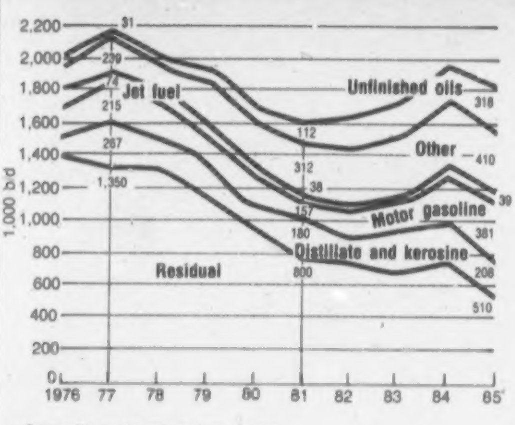
As stock-carrying costs increased with high interest rates, it became imperative that stocks be reduced. A concentrated effort was made to reduce stocks to a level consistent with demand.

The preferred way to determine the adequacy of stocks is to measure them in terms of days' supply. Total stocks represented 58 days' supply in 1973. This increased to 78 days at year-end 1981. After the sharp reduction in stocks, there was some concern about the adequacy of stock levels, but stocks at year-end 1984 still represented over 70-days' supply at the reduced demand level of 1984. The additional sharp cut in stocks in 1985 dropped the days' supply represented by year-end 1985 total stocks to 65.33 days. This is the lowest level since 1974.

With demand expected to increase, stocks will not be reduced further. Stocks are close to a minimum level if supply disruptions are to be avoided; although, the refining and distribution network is continually being adjusted to increase efficiency and minimize operating costs.

SPR stocks surpassed industry crude oil stocks in 1983.

Crude oil stocks in the Strategic Petroleum Reserve surpassed



Source: Energy Information Administration

REFINED PRODUCT IMPORTS

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
	1,000 b/d									
Gasoline	131	215	190	181	140	157	197	247	299	381
Kerosine	9	19	11	9	10	7	13	11	12	8
Jet fuel-kerosine	61	53	67	55	49	31	23	29	48	30
Jet fuel-naphtha	15	21	19	22	31	7	5	1	14	9
Distillate	143	248	173	196	142	173	93	174	272	200
Residual	1,396	1,350	1,355	1,150	941	800	776	699	681	510
Unfinished oils	32	31	27	56	55	112	174	234	231	318
Other*	219	239	165	264	283	312	344	327	454	410
Total U.S.	2,006	2,176	2,007	1,933	1,651	1,599	1,625	1,722	2,011	1,866

*Includes plant condensate

industry crude oil stocks in July, 1983. At year-end 1985, SPR stocks were 493 million bbl, while industry crude stocks were only 321 million bbl. There was some concern that additions to the SPR would be suspended in 1985, due to budget considerations, but the SPR continues to be expanded, reaching 500 million bbl at end May, 1986. The SPR does provide some backup in case of emergency, but no procedure has been established for using SPR crude, so it is doubtful that it greatly influences industry stock decisions. At present demand levels, the SPR stock represents only about 30 days supply.

The excess capacity situation in the world crude market led to a very competitive trading atmosphere in crude oil products. This resulted in the rapid expansion of spot market transactions and the development of a futures market for major products and crude oil. Import transactions became dominated by spot market trading.

It is estimated that spot market trades represented about 5% of U.S. total imports in 1977–1978. This rose to over 50% in 1984. The volume of imported crude and products traded on the spot market has risen from about 450,000 b/d in 1977–1978 to an estimated 2.85 million b/d in 1984, an increase in spot market trading of 2.4 million b/d, 433.3%.

In addition to the rapid increase in actual spot market trading, most of the contracts became related to prices on the spot market. This increase in competitive spot market trading and price volatility led to the net-back contracts that have now become prevalent.

The increase in price fluctuation and spot market trading introduced an element of risk into crude trading.

The increase in spot market trading and the fluctuation in prices introduced an element of risk into crude and product trading that did not exist in the past. This has led to the development of a futures market for major petroleum products and for crude oil.

Total annual contract volumes traded on the New York Mercantile Exchange moved up from 50,000 contracts in 1978 (50 million barrels) to 6,989,000 contracts in 1985, almost 7 billion barrels. The futures market has become an important barometer of the volatile movement in prices in today's market.

Outlook

The high oil prices of the 1980–1985 period helped boost U.S. domestic production. A surge in exploration and drilling resulted in the development of smaller reservoirs and prevented the natural decline curve from taking hold in the older producing areas of the lower 48 states. In fact, lower 48 production increased 166,000 b/d from 6.98 million b/d in 1980 to 7.146 million b/d in 1985.

The slide in crude oil prices between 1981 and 1985 cut drilling activity substantially, but the vast number of additional wells and investment in enhanced oil recovery helped sustain production. The sharp drop in prices during the first half of 1986 has almost totally destroyed exploration and drilling activity, and new well completions have fallen precipitously. In addition, many of the marginal wells that were helping to sustain the high production levels are uneconomic at these lower prices and will be shut in.

Domestic production will decline over the forecast period due to the sharp reduction in drilling.

Therefore, U.S. production is expected to decline throughout the forecast period. Crude and condensate production will be down 14.6% by 1991 to an average 7.51 million b/d. This will be 1.280 million b/d below the 1986 level and 1.461 million b/d below the recent high in 1985. The decline in production is already taking hold in early 1986.

NGL production is also expected to slip over the forecast period, due to lower prices and reduced natural gas production. By 1991, NGL production will be down 2.7% to 1.63 million b/d. The result will be that total U.S. domestic liquids production will fall 1.325 million b/d between 1986 and 1991, a drop of 12.7%. This will be down 1.496 million b/d, 14.1%, from the 1985 output level.

This is a rather optimistic and conservative estimate of the decline in U.S. domestic production over the forecast period. If prices stay depressed for longer than anticipated, the decline rate could be much steeper than anticipated. With the much lower rate of drilling activity, it will be impossible to prevent a decline in reserves over the forecast period, and the reserves-production ratio will undoubtedly also fall over this period.

It has been estimated that a massive exploration and drilling effort will have to be launched in order to slow the decline. Replacing reserves is essential to the long-term viability of the domestic industry and to U.S. energy security, but worldwide economic forces do not presently support exploitation of these higher-cost domestic resources. If the energy security issue is of concern, then the government will have to take action to assist the industry by reducing the tax burden or eliminating other restrictions. Lower domestic production and increasing demand mean a widening gap between domestic supply and domestic demand that will have to be filled by imports.

Total imports will increase substantially to fill the gap between rising demand and declining production.

Total industry imports, excluding crude imports for the Strategic Petroleum Reserve (SPR), will increase 42.6% over the 1986–1991. Imports will increase 2.44 million b/d, from 5.73 million in 1986 to 8.17 million in 1991. This will be up 64.4% from 1985 imports of 4.969 million b/d. Total imports peaked in 1977 at 8.786 million b/d, and remained above 8 million b/d until 1980, when demand fell sharply. With the decline in domestic output, we are moving back to that import level.

Crude oil imports will lead the way, moving up 60.9% over the forecast period to 6.1 million b/d. Because of the excess refining capacity available in the U.S., product imports are not expected to rise as rapidly. They will increase 6.7% to 2.07 million b/d. However, if products become available worldwide at prices much lower than domestic products, imports could increase substantially.

Dependency on imported oil will move up markedly over the forecast period. Net imports (total imports less exports), as a percentage of domestic demand, will increase from 30.6% in 1986 to 42.9%

U.S. REFINED PRODUCTS, NATURAL GAS LIQUIDS, AND CRUDE STOCKS

Refined product stocks	**1976**	**1977**	**1978**	**1979**	**1980**	**1981**	**1982***	**1983**	**1984**	**1985**
	1,000 bbl									
Gasoline	234,272	260,624	240,694	240,159	264,011	256,425	247,085	225,042	246,307	225,148
Motor†	231,432	257,578	237,885	237,503	261,327	253,001	244,279	222,434	243,296	222,839
Aviation†	2,840	3,046	2,809	2,656	2,684	3,424	2,806	2,608	3,011	2,309
Special naphthas	4,441	4,034	4,071	4,196	4,929	3,965	3,474	3,153	2,951	3,909
Kerosine	12,514	18,015	14,334	15,821	11,568	11,042	10,792	7,861	11,893	7,502
Distillate	185,986	250,280	216,367	228,706	205,113	191,541	185,579	140,263	161,072	143,673
Residual	72,344	89,673	90,204	95,859	91,786	77,992	68,229	48,504	53,000	50,381
Kerosine jet fuel	25,590	28,283	27,707	32,926	35,723	34,011	32,001	32,346	35,118	33,825
Naphtha jet fuel	6,495	6,285	5,960	5,594	6,308	7,054	7,189	6,265	6,861	6,654
Natural gas liquids & LRG	109,883	128,518	134,890	125,597	137,460	150,170	114,497	116,817	108,446	81,707
Unfinished oils	110,488	113,190	108,723	117,652	123,938	111,348	105,277	108,018	93,506	106,656
Other refined products	48,404	48,577	53,053	45,274	45,426	46,295	44,023	42,429	41,192	45,106
Total product stocks	**810,417**	**947,479**	**896,003**	**911,784**	**926,262**	**889,843**	**818,146**	**730,698**	**760,346**	**704,561**
Crude stocks§	285,471	339,813	309,421	339,080	358,166	363,464	350,044	343,850	345,376	320,892
Total stocks	**1,095,889**	**1,287,292**	**1,205,424**	**1,250,864**	**1,284,482**	**1,253,307**	**1,168,190**	**1,074,548**	**1,105,722**	**1,025,453**

*Change in Energy Information Administration reporting basis

†Includes blending components

§Excludes stocks for Strategic Petroleum Reserve

Source: Energy Information Administration

in 1991. This was only 26.5% in 1985. Total imports as a percentage of domestic demand will move up from 35.4% in 1986 to 47.2% in 1991. Over the relatively short span of the forecast period, the U.S. will revert back to a dependency on foreign oils of the same magnitude as during the late 1970's, over 40%.

Since non-OPEC production is not expected to increase over this period, the additional imports will have to come mainly from OPEC sources. Imports from OPEC countries are expected to increase to close to 70% of total U.S. crude imports by the end of the forecast period.

THE OUTLOOK — U.S. SUPPLY

	1986	1987	1988	1989	1990	1991	Change 1986 to 1991	% change 1986 to 1991
PETROLEUM BALANCE (thousand barrels/day)								
DEMAND:								
Domestic demand	16,190	16,515	16,720	16,895	17,100	17,300	+ 1,110	+ 6.9
Exports	780	725	730	735	740	750	30	3.8
Total demand	**16,970**	**17,240**	**17,450**	**17,630**	**17,840**	**18,050**	**+ 1,080**	**+ 6.4**
SUPPLY:								
Crude production	8,790	8,350	8,020	7,830	7,660	7,510	1,280	14.6
NGL & other hydrocarbons	1,675	1,670	1,660	1,640	1,640	1,630	45	2.7
Total liquids	**10,465**	**10,020**	**9,680**	**9,470**	**9,300**	**9,140**	**− 1,325**	**− 12.7**
Crude imports (ex. SPR)	3,790	4,570	5,085	5,445	5,790	6,100	+ 2,310	+ 60.9
Product imports	1,940	1,980	2,005	2,025	2,050	2,070	+ 130	+ 6.7
Total imports	**5,730**	**6,550**	**7,090**	**7,470**	**7,840**	**8,170**	**+ 2,440**	**+ 42.6**
Other supply	735	750	760	770	780	790	+ 55	+ 7.5
Total supply	**16,930**	**17,320**	**17,530**	**17,710**	**17,920**	**18,100**	**+ 1,170**	**+ 6.9**
TOTAL STOCKS (million barrels)								
Crude stocks	320	330	340	350	350	360	+ 40	+ 12.5
Product stocks	690	710	730	750	780	790	+ 100	+ 14.5
Total industry stocks	**1,010**	**1,040**	**1,070**	**1,100**	**1,130**	**1,150**	**+ 140**	**+ 13.9**
SPR crude stocks	513	530	550	570	585	600	+ 87	+ 17.0
Total U.S. stocks	**1,523**	**1,570**	**1,620**	**1,670**	**1,715**	**1,750**	**+ 227**	**+ 14.9**
Industy stocks — days supply	62.4	63.0	64.0	65.1	67.8	69.4	+ 7.0	+ 11.2
Net imports — % of domestic demand	30.6	35.2	38.0	39.9	41.5	42.9	—	—
Total imports — % of domestic demand	35.4	39.7	42.4	44.2	45.8	47.2	—	—
CRUDE OIL PRICE (Av. U.S. wellhead) ($/barrel)	13.50	15.50	16.50	17.50	19.50	21.50	+ 8.00	+ 59.3

CAPITAL EXPENDITURES

CAPITAL EXPENDITURES

INDUSTRY SPENDING is a reflection of the total amount of money flowing into the U.S. oil and gas industry. And the amount of money flowing into the industry is closely tied to the prices of crude oil, petroleum products and natural gas.

For the oil and gas industry, spending and prices have been tied extremely closely over the recent boom-bust cycle from 1977 to 1986. This has been a cycle of great amplitude with prices moving up sharply between 1977 and 1981, and then falling back again from 1981 through 1986. Capital expenditures have followed the same cycle, rising rapidly from 1977 through 1981 and then falling again from 1981 through 1986.

Review

Total industry capital spending moved up from $29.2 billion in 1978 to $82.9 billion in 1981.

The average wellhead price of domestic crude oil went from $9/barrel in 1978 to $31.77/barrel in 1981, an increase of 253%. Due to government price controls on some domestic production, the 1978 domestic price was somewhat lower than the world price. Therefore, the relative increase from 1978 to 1981 is larger. The average cost of imported crude oil increased from $13.30/barrel in 1978 to $35.10/barrel in 1981, an increase of 163.9%. The average refiner acquisition cost of crude oil, both domestic and imported, increased from $12.46/barrel in 1978 to $35.24/barrel in 1981, an increase of 182.8%.

Over the same three-year span, total U.S. oil industry capital spending shot up from $29.2 billion to $82.9 billion, an increase of 184.1%.

Over this upswing portion of the cycle, 1978 through 1981, exploration, drilling and production spending (including OCS lease bonus payments) increased from $20 billion to $57.8 billion, an increase of 189.2%. Spending for all of the other segments of the industry grouped together increased at a similar pace. Outlay for refining, marketing, transport, etc. moved up from $9.2 billion to $25.2 billion, an increase of 173.2%. With higher prices, the cash flow into the industry moved up, and there were substantially more funds available for investing during this period.

At the lofty prices for crude oil and higher natural gas prices, there were many more prospects that were economical for development. Even very marginally producing wells could be justified as profitable. At the time, expectations were for substantial additional price increases in subsequent years. As a result, in addition to much higher wellhead revenues, there was a lot of outside capital flowing into exploration and production activity. With adequate funds available, companies were expanding and upgrading other aspects of their operations; refining, petrochemicals, marketing and transportation. Some companies were diversifying into related industries, such as mining, or into other activities.

The slide in oil prices since early 1981 and the recent leveling of gas prices reduced total funds available to the U.S. oil and gas industry for reinvestment. As a result, U.S. oil and gas industry capital and exploration expenditures plummeted from the lofty levels of the

U.S. CAPITAL SPENDING

	1977	1978	1979	1980	1981	1982	1983	1984	1985
					(Million $)				
Drilling-Exploration	14,172	15,079	21,926	31,789	43,193	40,965	28,193	28,290	23,283
Production	2,659	3,132	4,490	6,191	7,984	7,144	5,531	5,590	4,567
OCS lease bonus	1,569	1,767	4,590	4,205	6,599	3,800	5,749	4,037	1,953
Subtotal	**18,400**	**19,978**	**31,006**	**42,185**	**57,776**	**51,909**	**39,473**	**37,917**	**29,803**
Refining	1,324	1,551	2,735	3,159	5,131	5,775	4,142	2,914	2,992
Petrochemicals	1,746	2,675	2,355	2,805	2,792	2,031	1,112	1,215	1,493
Marketing	687	982	851	1,276	1,619	1,349	1,614	2,221	2,611
Crude & products pipelines	1,630	989	1,509	1,777	2,052	1,121	2,456	1,689	1,137
Gas pipelines	873	809	1,491	3,642	4,947	5,179	4,707	3,971	2,084
Other transportation	438	468	583	804	895	515	456	386	458
Miscellaneous*	1,593	1,738	3,700	5,022	7,731	7,760	4,567	4,347	3,706
Subtotal	**8,291**	**9,212**	**13,224**	**18,485**	**25,167**	**23,730**	**19,054**	**16,743**	**14,481**
Total	**26,691**	**29,190**	**44,230**	**60,670**	**82,943**	**75,639**	**58,527**	**54,660**	**44,284**

*Includes mining and other energy

Source: Oil & Gas Journal

OGJ GROUP* PROFITS AND CAPITAL SPENDING

	Net income (Million $)	Capital & exploratory expenditures (Million $)	Capital & exploration expenditures % of net income
1977	12,550.0	26,811.0	213.6
1978	13,779.0	42,265.0	306.7
1979	23,130.0	53,261.0	230.3
1980	29,326.8	52,065.0	177.5
1981	28,205.4	66,895.8	237.2
1982	23,079.7	60,357.0	261.5
1983	22,325.5	45,584.1	204.2
1984	20,078.1	51,422.8	256.1
1985	15,801.5	50,907.5	322.2
Total 1977-1985	**188,276.0**	**449,569.2**	**238.8**

*Oil & Gas Journal group of 25-28 major oil companies

Source: Oil & Gas Journal

U.S. CAPITAL SPENDING (CONSTANT DOLLARS)

	1977	1978	1979	1980	1981	1982	1983	1984	1985
					(Million $)				
PPI*	**1.942**	**2.093**	**2.356**	**2.687**	**2.934**	**2.993**	**3.031**	**3.103**	**3.095**
Drilling & exploration	7,297.6	7,204.5	9,306.5	11,830.7	14,721.5	14,784.8	9,301.6	9,117.0	7,522.8
Production	1,369.2	1,496.4	1,905.8	2,304.1	2,721.2	2,900.4	1,824.8	1,801.5	1,475.6
OCS lease bonus	807.9	844.2	1,948.2	1,564.9	2,249.1	1,332.1	1,896.7	1,301.0	631.0
Subtotal	**9,474.8**	**9,545.2**	**13,160.4**	**15,699.7**	**19,691.9**	**19,017.4**	**13,023.1**	**12,219.5**	**9,629.4**
Refining	681.8	741.0	1,160.9	1,175.7	,748.8	1,573.7	1,366.5	939.1	966.7
Petrochemicals	899.1	1,278.1	999.6	1,043.9	951.6	524.6	366.9	391.6	482.4
Marketing	353.8	469.2	361.2	474.9	551.8	446.7	532.5	715.8	843.6
Crude & prod pipelines	839.3	472.5	640.5	661.3	699.4	441.0	810.3	544.3	367.4
Gas pipelines	449.5	386.5	632.9	1,355.4	1,686.1	2,028.1	1,553.0	1,279.7	673.3
Other transportation	225.5	223.6	247.5	299.2	305.0	172.1	150.4	124.4	148.0
Mining & other energy	—	—	658.3	945.7	1,442.7	1,177.4	579.7	606.8	400.3
Miscellaneous	820.3	830.4	912.1	923.3	1,192.2	1,431.3	927.1	794.1	797.1
Subtotal	**4,269.3**	**4,401.3**	**5,612.9**	**6,879.4**	**8,577.7**	**7,794.9**	**6,286.4**	**5,395.7**	**4,678.8**
Total	**13,744.1**	**13,946.5**	**18,773.3**	**22,579.1**	**28,269.6**	**26,812.2**	**19,309.5**	**17,615.2**	**14,308.2**

*Producer's Price Index (1967 = 1.00)

1981 and 1982 peak boom years.

Capital spending by U.S oil companies peaked in 1981 at $82,943 million. It fell to $75,639 million in 1982 and then dropped sharply to $58,527 million in 1983. Spending dropped in 1984 to $54,660 million and down to $44,284 million in 1985. This was a drop of 46.6% from the peak in 1981 through 1985.

Exploration, drilling and production outlays fell from $57,776 million in 1981 to $29,803 million in 1985, a drop of 48.4%.

Exploration, drilling, and production outlays fell 48% from 1981 to 1985.

Average prices did not fall quite as sharply over that period. The average wellhead price of domestic crude oil fell $7.69/barrel to $24.08 barrel in 1985, down 24.2%. The average refiner acquisition cost of crude oil dropped 24.1%.

Over this same period, there was also a drop in demand for petroleum products and natural gas, so the cash flow impact on individual companies was greater than reflected in just the price change. In the face of lower prices and demand, firms cut spending to help their profit pictures.

The expectation of higher oil prices not only increased the flow of outside capital, but also encouraged a number of companies to increase their debt for expansion. As prices fell, the debt became a prohibitive burden. The necessity to repay the debt with funds from lower-valued oil has severely restricted the investment capability of many firms.

Industry restructuring has also contributed to the reduction in capital spending.

In addition, the majority of oil companies have been forced into reorganization to prevent hostile takeovers and dismemberment. The fall in prices and oil company revenues rapidly changed the perception that outside investors had of the future potential of the oil industry. Most of the companies had been restructuring since the peak period by cutting costs and shedding surplus facilities. However, outside interests saw a profit opportunity in forcing rapid restructuring. This has resulted in a wave of mergers, stock repurchase plans and other moves to fend off hostile takeovers. The result for most companies has been a substantial additional increase in debt. This has further reduced funds available for reinvestment.

The level of capital spending follows company profits along with prices, but it can fluctuate greatly. For the *Oil & Gas Journal* group of 25 oil companies, worldwide capital and exploration expenditures as a percentage of net income ranged from 176.5% in 1980 to 322.2% in 1985. The average from 1978 through 1985 was 224.8%.

This group of companies has maintained a high level of capital investment relative to profits, despite the downturn. Their planning horizons always tended to be relatively long range, but with the present low prices and the outside threat of takeovers, they will probably be forced to adhere more closely to the present short-range market philosophy of the investment community. The longer-range outlook might pay larger future returns, but most investors aren't looking very far into the future.

The exploration, drilling and production segments of the domestic industry have been particularly hard hit by the lower prices. The lower prices have markedly reduced the wellhead revenues from crude oil and natural gas production. This has diminished the funds available for reinvestment in drilling activity. In addition, many companies have to use available funds to reduce the debt burden left over from the boom period.

With oil prices down and pessimistic future price prospects, the flow of outside capital into the industry dried up. The glamour left oil investing and the highly speculative funds that flowed into the industry in the 1979–1982 period, in anticipation of a potential high rate of return, are now being invested elsewhere.

The wellhead revenue reinvestment ratio, an indicator of the attractiveness of oil investing, fell to an extremely low level. Rig activity fell to the lowest level recorded; at least the lowest level since the Hughes Tool Company started counting active rigs on a regular basis.

Spending cuts have been deeper than the decline in prices.

The 10-year cycle now appears to have been completed. The average price of crude oil for 1986 is estimated at $13.50/barrel. The average cost of crude oil imports in 1977 was $13.24/barrel. Total industry domestic capital expenditures for 1986 are estimated at $27,420 million.

Outlays in 1977 were $26,691 million.

In fact, there has probably been a bit of an over-correction. Constant dollar outlays in 1977 were $13,947 million. They moved up to $28,269 million in 1981. Spending in constant dollars had fallen to $14,308 million in 1985. They will be down to about $8,600 million in 1986.

This would be close to the 1972–1973 level of spending, before prices began to move up. Spending cuts have been deeper than the decline in prices.

INTERNATIONAL SPENDING – U.S. FIRMS

	1982	1983	1984	1985	1986
	$ million				
Exploration-Production					
Drilling-Exploration	6,722	5,622	3,455	3,660	3,178
Production	3,570	2,940	1,831	1,804	1,733
Subtotal	**10,292**	**8,562**	**5,286**	**5,464**	**4,911**
Other					
Refining	781	696	808	883	731
Petrochemicals	602	467	219	197	162
Marketing	666	638	640	795	662
Pipelines	131	141	148	125	101
Other transportation	250	162	24	11	9
Mining & other energy	805	869	690	642	526
Miscellaneous	415	650	278	326	203
Subtotal	**3,650**	**3,623**	**2,807**	**2,979**	**2,394**
Total	**13,942**	**12,185**	**8,093**	**8,443**	**7,305**

Source: Oil & Gas Journal

Outlook

This may well be the start of a new cycle, but its beginning will not be as volatile as the last one. The last few years were a period of radical adjustment for companies in the industry. It was necessary for most to restructure and cut costs sharply. As the effects of the cost cutting begin to show up in improved profit, investment will respond. In addition, as the companies reduce the heavy debt load, investment can be increased. The lower debt load and improved profits will also attract outside funds into the industry.

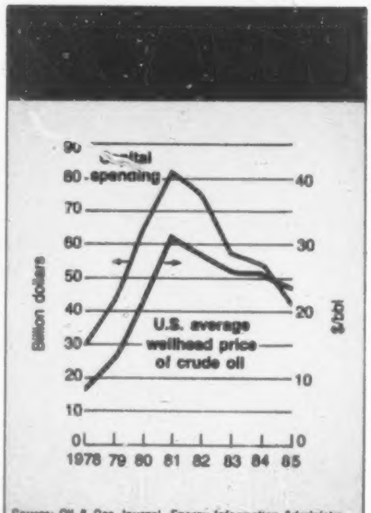
However, it is not expected that there will be anything close to the surge in spending that occurred during the 1980–1982 period. Instead, capital expenditures will closely follow revenue and price movements, economic activity, and energy and oil demand.

U.S. domestic expenditures for exploration and production activities will tend to follow the pattern of movement of oil prices over the forecast period. Spending in this sector of the domestic industry will increase steadily throughout the forecast period. Outlays will increase 76.2% by 1991 from the depressed 1986 level. Spending on exploration and production will increase to $30,390 million by the end of the forecast period, an increase of $13,140 million.

Spending will move up slowly during the initial years of the forecast period 1987–1989, while prices remain relatively low. As prices begin to move up more rapidly in the latter years 1990 and 1991, outlays for exploration and production will accelerate. Outlays for exploration and drilling alone will increase $10,470 million to $23,980 million in 1991, up 77.5%.

Drilling costs have fallen sharply from the peak in 1982, and it is expected that they will come down even more during the initial years of the outlook period. This will improve the economics of exploration and drilling, and boost the level of activity. With the large inventory and capacity surplus in the drilling and service, and supply industries, drilling costs will not move up very rapidly during the forecast period. In fact, drilling costs may remain relatively stable for the foreseeable future. This will help improve the economics of exploration and development activity.

Once prices stabilize and begin to move up again, some outside investment funds will return to the industry. This will be particularly true in the later years if prices move up more rapidly. The independent sector of the U.S. domestic industry does the majority of the drilling, but relies heavily on outside investment funds. When prices appear a bit more certain, investors will return.



Source: Oil & Gas Journal, Energy Information Administration

Spending on domestic exploration and production will follow prices and increase over the forecast period.

It may also become obvious that there is a necessity to replace rapidly depleting domestic oil and gas reserves. This may result in more favorable tax treatment for the industry, and possibly even the removal of controls on natural gas. This would give a boost to exploration and drilling activity as well as investment.

Spending for production facilities will follow drilling activity. Outlays will increase 77.7% to $4,710 million by 1991.

Outer continental shelf (OCS) lease bonus payments fell sharply from $6,599 million in 1981 to an estimated $1,090 million in 1986. It is expected that OCS bonus payments will increase over the forecast period as the economics of the available leases improves with the rising prices, but it is not expected that bonus payments will increase as rapidly as exploration and drilling. OCS payments will increase 56% to $1,700 million in 1991.

Spending on downstream facilities will increase over the 1986–1991 period, moving up 30%.

Spending on downstream facilities and other projects will not increase as rapidly over the forecast period, but spending will move up as higher prices and lower costs make more funds available for investing. Spending will increase 29.4% to $13,160 million in 1991, up from $10,170 million in 1986.

Refining and petrochemical investments remained at relatively high levels, even though demand for petroleum products fell for five consecutive years, 1978–1983. High levels of investment were viewed as essential for improved future profitability. Refiners cut back on overall distillation capacity, but continued to invest in upgrading facilities. Higher profitability is in increased yields of higher priced light products. Refiners also wanted the flexibility to use heavier, cheaper crudes as feedstock to cut costs.

Much of the excess capacity in the U.S. has been eliminated. But the industry is still quite competitive and there is more competition from foreign products.

Because of the lower crude costs and the new net-back contracts, refining turned more profitable in 1986. It is expected that capital expenditures will move up over the forecast period as refiners try to continue to improve facilities and their profit margins.

The petrochemical industry is also faced with increasing foreign competition and excess capacity. Investment to improve technology and reduce costs is essential if companies wish to compete. Outlays for refining and petrochemical operations will increase 30.6% to $4,100 million in 1991.

Capital spending for marketing facilities is expected to continue to move up throughout the forecast period. The high level of competition in the marketing sector has stimulated investment as companies strive to maintain and/or gain market share. Spending is expected to move up 29.6% to $2,760 million in 1991.

Transport spending, principally for pipelines, will follow a similar pattern. Spending will increase 38% to $2,540 million in 1991.

Spending by U.S. oil companies for mining and other activities is expected to move up more moderately over the forecast period than other categories of spending. A number of companies have sold or discontinued their mining and metals operations. Outlays will increase about 22.9% to $3,760 million.

International expenditures by a sampling of U.S. companies shows that overseas investment will be down in 1986. Spending plans for this group calls for total outlays of $7,305 million in 1986, down 13.5% from 1985. This is not as sharp a drop as for domestic spending, which is expected to be down 38.1%.

This is indicative of a temporary shift to more investment in international activities. With lower cost, more profitable exploration and production activity possible overseas, U.S. companies will be diverting more of their investments to international operations than in past years. With the lower prices reducing the revenues flowing into many producing countries, it may be possible to negotiate some attractive exploration agreements.

Overseas downstream investments will probably continue to fall, however. The worldwide industry has a much larger refining and petrochemical overcapacity than the U.S., and new facilities in the Middle East have further added to the problem. Some investment will be shifted from U.S. domestic activities to the international scene, but the funds will be selectively invested in the most profitable sectors of the business.

There will be a shift to investment outside the U.S.

THE OUTLOOK — CAPITAL EXPENDITURES

	1986	1987	1988	1989	1990	1991	Change 1986 to 1991	% change 1986 to 1991
U.S. DOMESTIC OIL INDUSTRY CAPITAL EXPENDITURES ($ million)								
Drilling & exploration	13,510	14,450	15,380	17,230	21,750	23,980	+10,470	+77.5
Production	2,650	2,840	3,020	3,380	4,270	4,710	+ 2,060	+77.7
OCS lease bonus	1,090	1,240	1,320	1,400	1,540	1,700	+ 610	+56.0
Subtotal	**17,250**	**18,530**	**19,720**	**22,010**	**27,560**	**30,390**	**+13,140**	**+76.2**
Refining & petrochemicals	3,140	3,340	3,460	3,610	3,900	4,100	+ 960	+30.6
Marketing	2,130	2,300	2,380	2,460	2,610	2,700	+ 630	+29.6
Pipelines and transport	1,840	1,920	1,990	2,120	2,400	2,540	+ 700	+38.0
Mining and other	3,060	3,250	3,350	3,450	3,610	3,760	+ 700	+22.9
Subtotal	**10,170**	**10,810**	**11,180**	**11,640**	**12,520**	**13,160**	**+2,990**	**+29.4**
Total spending	**27,420**	**29,340**	**30,900**	**33,650**	**40,080**	**43,550**	**+16,130**	**+58.8**
PRICES:								
Crude oil (Av. U.S. wellhead—$/barrel)	13.50	15.50	16.50	17.50	19.50	21.50	+8.00	+59.3
Natural gas (Av. U.S. wellhead—$/mcf)	1.95	1.95	2.00	2.05	2.15	2.25	+0.30	+15.4
Motor gasoline (Av. all types—$/gallon)	0.895	0.975	1.015	1.060	1.140	1.225	+0.33	+36.9

EXPLORATION AND PRODUCTION

EXPLORATION AND PRODUCTION

NOWHERE is the risk inherent in the oil industry more evident than in U.S. exploration and drilling. This sector of the industry has gone through some extremely volatile cycles during its history, and it is in the midst of one at the present time.

In four-and-a-half years, drilling activity in the U.S. went from a record high to a record low. In an industry known for its boom or bust eras, this cycle has been the most extreme.

But this segment of the industry has been amazingly adept at rapidly adusting to shifts in economic conditions. And it will adjust to the changing economics in the coming years.

Review

The number of active rotary drilling rigs increased from an annual average of 976 rigs in 1971 to a peak of 3,970 rigs in 1981. This was an increase of 2,994 active rigs, 306.8%. This size of domestic drilling quadrupled over that eleven-year span. This weekly count actually peaked at 4,530 active rigs during the last week of December, 1981.

The rig count fell from a peak of 4,530 at year-end 1981 to a record low of 663 in July 1986.

Then the rig count fell precipitously. The active rig count fell for ten consecutive months, hitting a 1982 low of 2,379 in October, and averaging 3,105 active rigs for the year. There was a slight seasonal upturn at the end of the year, but the count continued its decline. The number of active rigs fell to 1,807 in April 1983, 2,723 rigs lower than the peak, and a drop of 60.1%. The annual average for 1983 was 2,232 active rigs, down 1,738 rigs, 43.8% below the peak.

There was a slight upturn in 1984, as the rig count for the year averaged 2,428, but then the count slipped again, falling to an average of 1,980 in 1985. The year ended with a December average of 1,950 active rigs.

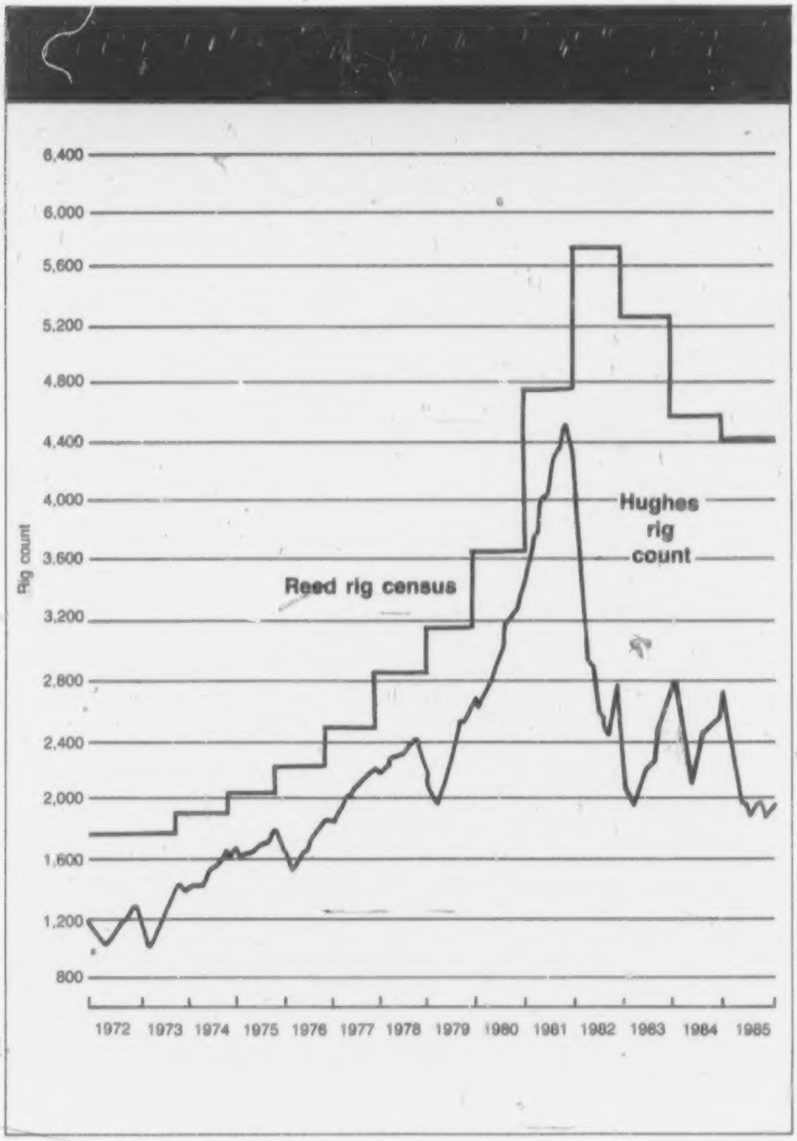
Then the count went on another precipitous fall, dropping to a record monthly low of 686 active rigs in July, 1986. The record weekly low was recorded July 14, 1986 at 663 rigs. This was a drop of 3,867 active rigs, 85.4%, in 54 months.

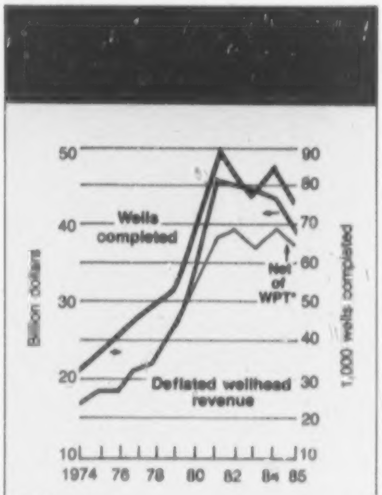
It was the slide in crude oil prices, and the sharp drop in the longer range outlook for oil prices, that led to the initial downturn in drilling activity.

During the 1980–1982 drilling boom, expectations that crude oil prices would soon reach $50 bbl and continue to climb stimulated a surge in drilling activity. With an industry consensus supporting this outlook for higher prices, investment funds flowed into the drilling industry, and banks actively sought investors in oil exploration projects. The funds were available and analysis supported investment, even if it required substantial debt. Everyone wanted to drill for oil, and the rig count skyrocketed.

Then prices stopped climbing and the economics changed slowly. Prices actually turned around in February and March, 1981. The U.S. refiner acquisition cost of imported crude peaked in February, 1981 at $39 bbl. Domestic refiner acquisition cost and wellhead price peaked in March, 1981, at $36.97 and $34.70, respectively.

Few analysts or investors picked up on the implications of the





*Windfall profits taxes

Source: Wells completed, American Petroleum Institute; Wellhead revenue, author's estimates

WELL COMPLETIONS, FOOTAGE, AND ACTIVE RIGS

	Active rigs	Total well completions*	Total footage* (1,000 ft)	Average ft. well	Avg. wells per rig	Avg. ft. per rig (1,000 ft)
1973	1.195	27.692	139.424.738	5.035	23.17	116.673
1974	1.471	33.037	153.776.399	4.655	22.46	104.539
1975	1.660	38.884	181.039.993	4.656	23.42	109.060
1976	1.656	40.940	187.289.586	4.575	24.72	113.098
1977	2.001	45.855	215.695.878	4.704	22.92	107.794
1978	2.255	50.061	238.386.248	4.762	22.20	105.715
1979	2.176	51.890	243.685.430	4.696	23.85	111.988
1980	2.910	69.486	311.444.837	4.482	23.88	107.026
1981	3.970	89.234	406.520.453	4.556	22.48	102.398
1982	3.105	83.889	375.382.919	4.475	27.02	120.896
1983	2.232	75.738	316.617.464	4.180	33.93	141.854
1984	2.428	85.359	368.336.310	4.315	35.16	151.704
1985	1.980	74.919	319.993.038	4.271	37.84	161.613

*Excludes service and stratigraphic wells and core tests

Source: American Petroleum Institute and Hughes Tool Co turnaround at that early date. Any leveling of prices was considered temporary or regional. Aggregate data prepared by the government was not available. It takes 3–5 months for government agencies to collect, aggregate and publish the information. And, at the prevailing prices, many projects were still economical. So the drilling boom continued throughout 1981 and into 1982, as crude prices fell.

Many projects were financed based upon expectations of $45-$50/bbl oil, and a correction proved inevitable. The shakeout from this overly optimistic period is continuing. Prospects for near-future appreciation of the value of crude oil diminished considerably. Therefore, the outside investments have declined. Part of the boom was financed by speculative investing, which tends to chase the highest expected rate of return. So, much of that investment money moved away from the petroleum industry.

The initial drop in drilling activity was greater than would have been expected. Because of declining drilling costs, the economics of drilling was probably better in years 1982–1985, following the drop in crude prices, but many companies had become burdened by heavy debt in their attempts to expand rapidly during the boom period. This led to sharp cut-backs in activity that exaggerated the decline.

The seismic crew count has led drilling activity and well completions.

One of the best indicators of expected rig activity is the level of seismic crew activity in the United States. Seismic crew activity peaked in September, 1981, at 744 total crews. This was 3 months prior to the peak in drilling activity, and was one of the early warning signals of the downturn. The number of active seismic crews fell steadily to 447 in March, 1983. This was one month before the rig count hit bottom at 1,846 average active rigs in April. The number of active seismic crews moved up to 498 by October, 1983, an increase of 11.4%. The rig count moved up 38% from April to November, 1983. The seismic crew count fell slightly in early 1984, rose in mid-year and then fell at year-end. The seismic crew count fell sharply during the first half of 1985, leading the downturn in rig activity. It moved up marginally in the middle of 1985, but then started down again in August, 1985, again leading the decline in drilling activity. By May, 1986, the count had fallen to 191. This was down 74.3% from the peak.

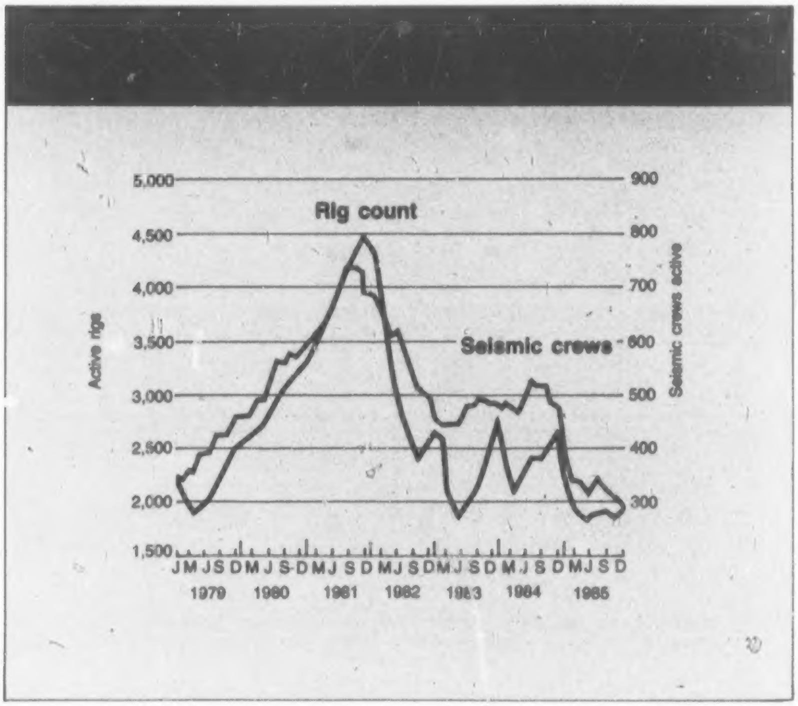
Well completions peaked in 1981 at 89,234 wells, up 239.7% from 1971.

The increase in drilling activity in the 1971–1981 period resulted in a substantial surge in well completions. Total well completions increased from 26,268 in 1971 to 89,234 in 1981, an increase of 239.7%. Over that same period, rig activity increased 306.7%. Rig efficiency declined somewhat over the period, as new, less efficient crews were employed on the new rigs, and deeper wells were being drilled.

From the peak in 1981, well completions have fallen more slowly than the Hughes rotary rig count. The number of well completions in 1982 was 83,889, down 6% from 1981. The rig count that year fell 21.8%. By 1985, the rig count had fallen 51%, to 1,980, but well completions were down only 16% from the peak at 74,919.

It should also be noted that the footage drilled has not fallen as fast as the rig count, but has remained more closely aligned to the well completions. The total footage drilled peaked at 406.5 million feet in 1981. This had dropped to 320 million feet in 1985, down 21.3%.

Well completions and the footage drilled have held up quite well when compared to the sharp drop in rotary rig activity. One of the reasons for this is an improvement in rig efficiency. The statistics would indicate a marked improvement in rig efficiency. The average number of well completions per active rig averaged about 24 over the



U.S. PRODUCING WELLS

	1977	1978	1979	1980	1981	1982	1983	1984	1985*
Well completions:									
Oil wells	18,700	19,065	20,689	32,120	42,520	39,252	37,396	43,012	38,106
Gas wells	12,119	14,405	15,166	17,132	19,742	18,810	1,450	16,960	15,388
Net abandonments:									
Oil wells	10,776	9,347	6,046	15,798	33,228	16,119	14,248	25,495	12,178
Gas wells	1,544	4,969	2,729	5,019	2,907	6,896	3,306	12,588	3,370
	12,320	**14,316**	**8,775**	**20,817**	**36,135**	**23,015**	**17,554**	**38,083**	**15,548**
Producing wells (Dec. 31)									
Oil wells	507,034	516,752	531,395	547,717	557,009	580,142	603,290	620,807	646,735
Gas wells	148,018	157,454	169,891	182,004	198,839	210,753	221,952	226,324	238,342
	655,052	**674,206**	**701,286**	**729,721**	**755,848**	**790,895**	**825,242**	**847,131**	**885,077**

*Estimates except for completions

Source: API, abandonments calculated by author

DRILLING COSTS*

	Total wells†	Total footage† (1,000 ft)	Total expenditures ($ 000)	Avg. cost per well	Avg. cost per foot
1973	26,244	136,661	3,074,532	117,152	22.50
1974	31,481	150,944	4,366,989	138,718	28.93
1975	36,960	177,642	6,571,214	177,793	36.99
1976	38,941	184,418	7,461,680	191,615	40.46
1977	43,826	212,694	9,956,453	229,181	46.82
1978	46,655	230,619	13,061,090	279,950	56.64
1979	48,523	237,512	16,078,930	331,367	67.71
1980	62,011	296,031	22,800,356	367,682	77.03
1981	80,816	388,800	36,665,456	453,691	94.30
1982	76,652	362,618	39,428,119	514,378	108.73
1983	67,536	301,226	25,104,543	371,721	83.34
1984	77,210	350,589	25,206,219	326,463	71.90

*From the Joint Association Survey †Doesn't agree with other reported figures because based on survey

The number of well completions per active rotary rig has moved up sharply.

1971–1981 period. This moved up to 27 in 1982, and then jumped to 33.9 in 1983, 35.2 in 1984 and 37.8 in 1985, as the rig count plummeted and well completions remained relatively high.

The average number of wells greater than 2,500 feet completed per rig may be a better indicator of efficiency. This moved up from an average 16.7 during 1971–1981 to 18.2 in 1982. It then increased to 21.7 in 1983, 23.4 in 1984 and 24.5 in 1985. This may be a better measure because one of the major reasons for the disparity between rig count and well completions may be the lack of statistical data covering all rig activity. The Hughes Tool Company weekly survey of rig activity records rotary rigs with the drilling depth capability greater than 2,500 feet. Many, if not most, of the shallower wells are drilled with other types of rigs, which are not counted in this weekly survey. Since shallower wells are far less costly, the drop in oil prices may not have had as big an impact on their activity. Therefore, a large percentage of the shallower drilling activity has continued during the downturn in the drilling industry.

Although rig efficiency probably has improved, the actual improvement in productivity is probably marginal when measured annually. Therefore, this ratio of wells to active rotary rigs is not truly a measure of efficiency. It is probably more an indicator of the large number of wells drilled with other than rotary rigs.

Also of note is the fact that the average depth of wells drilled fell during the 1983–1985 period. The average depth during the 1980-1982 drilling boom was 4,550 feet. This dropped to 4,180 in 1983, 4,315 in 1984 and 4,271 in 1985. This would also show up in the improved rig efficiency. Part of the reason for the drop in average depth was a shift away from deep gas well drilling to shallow oil well drilling.

The drop in demand for natural gas and the slow-down of the climb in natural gas prices led to the curtailment of a substantial amount of natural gas drilling. Between 1979 and 1983, demand for natural gas fell 17%. This led to the present natural gas surplus and resulted in a decline in gas well drilling. This was particularly true for deep gas wells, below 10,000 feet. Close to 1,500 of the rigs that were idled were attributed to the decline in deep well drilling.

To better understand the recent volatile swings in exploration and drilling activity, it is best to look at the level of wellhead prices and wellhead revenues.

Between 1971 and 1973, the average wellhead price of oil moved up 123%, and the rig count increased 70.1%. From 1975 to 1981, the average wellhead price increased 320.2%, and the rig count moved up 139.2%. Then, from 1981 through 1985, the average wellhead price fell 24.2% and the active rotary rig count fell 50%.

The price of natural gas increased 1018% between 1973 and 1982.

The average wellhead price of natural gas was also on a rapid rise throughout this period. The price increased from 22c per thousand cubic feet (mcf) in 1973 to $2.66 mcf in 1984. The rate of increase slowed in the latter years. Between 1973 and 1982, the price increased 1018%. This is an average annual increase of about 31%. The price moved up an additional 5.3% in 1983, and 2.7% in 1984, but then the price turned down in 1985, dropping 6.8%. Expectations are that the price will decline another 20+% in 1986.

The prices of crude oil and natural gas, along with their production, determine the level of wellhead realizations for reinvestment in exploration and drilling. This pool of funds available from oil production, and the percentage reinvested, are the key determinants of drilling activity.

TOTAL WELLHEAD REALIZATIONS AND REINVESTMENT

	Total wellhead revenues	Net of WPT*	(JAS) Total drilling expenditure	Investment ratio %
1965	10,652,840		2,407,437	22.6
1966	11,429,182		2,360,740	20.7
1967	12,274,468		2,299,178	18.7
1968	12,963,514		2,409,360	18.6
1969	13,882,295		2,610,671	18.8
1970	14,919,586		2,578,682	17.3
1971	15,778,480		2,371,492	15.0
1972	15,886,972		2,814,166	17.7
1973	17,951,977		3,074,532	17.1
1974	28,153,951		4,366,989	15.5
1975	32,061,121		6,571,214	20.5
1976	35,801,316		7,461,680	20.8
1977	41,615,676		9,956,453	23.9
1978	46,562,738		13,061,090	28.1
1979	63,164,966		16,078,930	25.5
1980	97,765,720	87,840,720	22,800,356	26.0
1981	138,947,637	113,003,637	36,665,457	32.4
1982	135,526,277	118,772,277	39,428,119	33.2
1983	124,592,334	113,924,334	25,104,543	22.0
1984	132,048,177	124,174,177	25,206,219	20.2
1985E	121,100,304	117,100,304	20,671,800	17.7

E-Estimate. *Windfall profit tax.

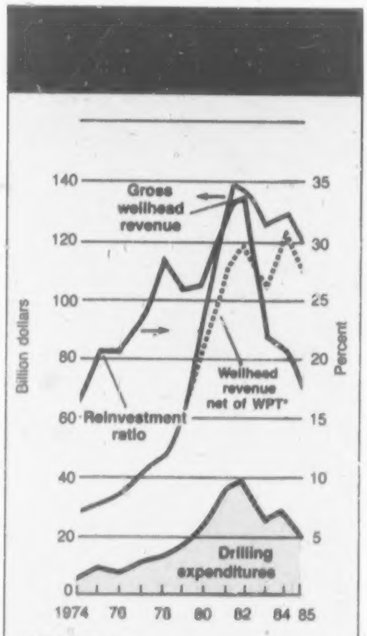
Source: 1970-1984 API, 1985 Author's estimate

INDEX OF COST OF DRILLING AND EQUIPPING WELLS

(1979 = 100)	Weight (%)	1980	1981	1982	1983	1984	1985*
Payments to Drilling Contractors	31.0	115.2	140.8	146.7	102.5	89.7	90.6
Purchased items							
Road site preparation	5.3	111.3	119.9	126.6	134.7	139.3	142.1
Transportation	4.1	112.5	123.4	125.4	125.4	125.4	125.4
Fuel	1.5	149.1	181.9	177.5	161.9	159.0	148.5
Drilling mud and additives	7.1	117.1	132.9	137.2	104.6	97.3	98.5
Well site logging and or monitoring system	1.5	119.8	144.7	148.6	148.6	148.6	148.6
All other physical tests	0.6	112.7	117.0	123.3	123.3	123.3	123.3
Logs and wireline evaluation services	3.1	108.8	131.8	133.5	126.8	132.6	119.2
Directional drilling services	1.0	114.3	120.1	143.0	143.0	140.8	139.1
Perforate	1.6	120.4	140.8	153.8	153.8	153.8	153.8
Formation treating	4.5	120.8	141.6	131.4	117.1	110.6	104.1
Cement and cementing services	3.7	116.8	136.1	138.7	130.6	121.6	114.9
Casing and tubing	14.6	114.8	148.3	158.5	142.4	135.3	133.7
Casing hardware	0.6	114.8	148.3	158.5	142.4	135.3	133.7
Special tool rentals	3.8	108.6	118.2	134.4	134.4	130.1	130.1
Drill bits and reamers	1.8	111.5	124.2	135.9	146.6	146.7	144.6
Wellhead equipment	2.2	121.7	147.1	165.4	157.3	162.0	168.5
Other equipment and supplies	2.4	115.9	136.4	151.9	148.0	146.7	147.1
Plugging	0.4	110.7	126.7	135.7	136.6	138.7	136.1
Supervision and overhead	2.2	110.9	123.0	133.2	138.5	138.1	142.1
All other expenditures	7.0	116.2	128.6	132.1	133.5	136.4	136.9
Sub-total purchased items	**69.0**	**115.6**	**135.4**	**142.0**	**133.9**	**131.3**	**130.0**
Total†	**100.0**	**115.5**	**137.1**	**143.4**	**124.1**	**118.4**	**117.8**

*Preliminary. †Weighted according to 1982 weights for all years

Source: IPAA



*Windfall profits tax
Source: 1974-1984, American Petroleum Institute; 1985, Oil & Gas Journal

TOTAL U.S. OPERATING OIL WELLS

	1977	1978	1979	1980	1981	1982	1983	1984	1985
Flowing	31,815	31,927	34,786	34,529	38,060	36,065	32,994	36,104	37,665
Artificial lift	476,525	484,311	492,069	508,981	518,949	544,077	570,296	584,093	609,070
Total	508,340	516,238	526,855	543,510	557,009	580,142	603,290	620,197	646,735

Source: American Petroleum Institute

Total wellhead realizations reached $138.9 billion in 1981.

With rising oil and gas prices in the 1970s, total wellhead revenues moved up rapidly. Total wellhead realizations were $15,778 million in 1971. Total wellhead realizations peaked in 1981 at $138,947 million. This was the year of peak oil prices and a relatively high level of demand for natural gas. The windfall profit tax (WPT) took a portion of the revenues available in 1981. Net of this excise tax, total wellhead revenues, was $113,004 million. In addition to the high level of revenue available, the reinvestment ratio was the highest since 1970, at 32.4%. The reinvestment ratio is the percentage of total revenues available that are invested in drilling. Total drilling expenditures in 1981 were $36,665 million.

The windfall profit tax was enacted in 1980 as a revenue measure for the federal government. Although a federal excise tax, rather than a profit tax, it had general acceptance outside the oil industry because of the adverse impact on the general economy from the rapidly-rising oil prices. But it siphoned substantial funds away from the industry.

Total wellhead revenues and the reinvestment ratio remained high in 1982. Revenues, net of the windfall profit tax, totalled $118,772 million, with 33.2% reinvested in drilling. Total drilling expenditures were $39,428 million. As oil prices declined and natural gas demand fell, total wellhead realizations fell to $113,924 million in 1983, net of the WPT. In addition, the high debt that the industry had accumulated during the peak years had to be financed. This reduced the reinvestment ratio sharply to 22% in 1983. Drilling expenditures fell to $25,105 million. Total wellhead revenues moved up in 1984 to $124,175 million, net of WPT. Increased natural gas demand was the major reason for the increase. This was partially offset by lower crude oil prices. The reinvestment ratio fell to 20.2%. Total drilling outlays were an estimated $25,206 million in 1984. It should be noted that a portion of the drop in drilling expenditures in 1983 and 1984 was due to lower drilling costs. Therefore, the activity level did not drop as much as outlays.

Estimates for 1985 show wellhead revenues at $117,100 million, and the reinvestment ratio dropping sharply to a low 17.7%, with drilling outlays of $20,672 million.

The cost of drilling has fallen 40% since the peak in 1982.

The cost of drilling has fallen sharply since the peak of the drilling boom in 1981–1982. According to the Joint Association Survey of Drilling Costs, the average cost per well hit an all-time high of $514,378 in 1982. It fell sharply to $371,721 in 1983, a drop of 27.7%. The cost continued to slide in 1984, falling to $326,463, down 36.5% from the peak in 1982.

The sharp drop in well costs were primarily due to the competition in the market brought on by the excess capacity and inventory situation. Drilling contractors, as well as equipment and service companies, came away from the boom period with huge excess inventories and capacities. Prices were slashed in an effort to reduce inventories and use idle capacity.

Preliminary indicators are that the costs are continuing to fall. The estimated cost per well for 1985 is $306,580, down 6.1% from 1984, and 40% below the peak.

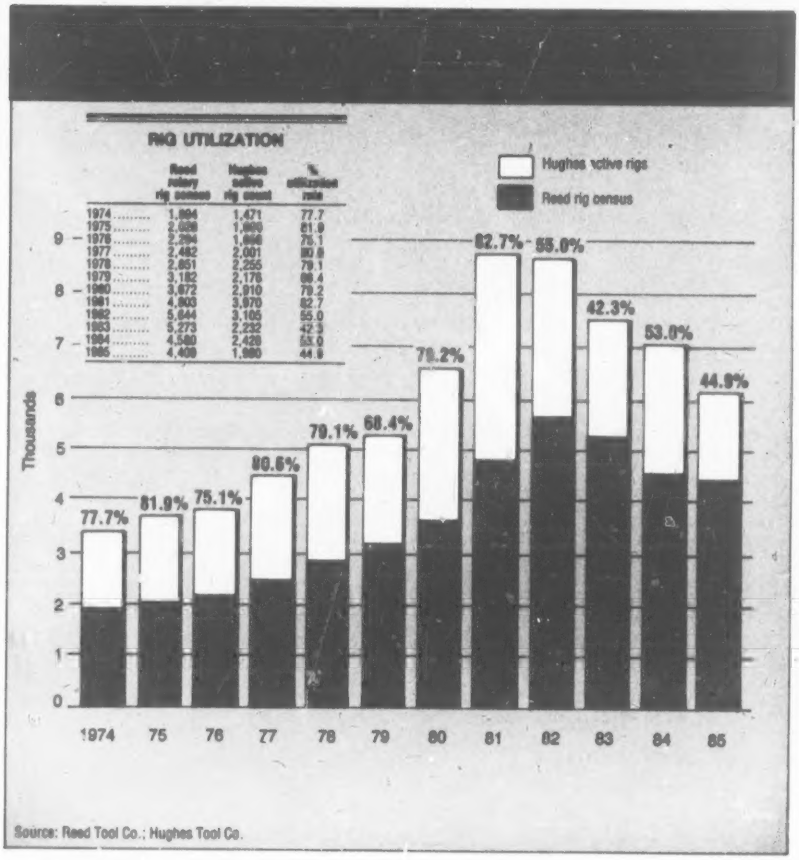
As stated, one of the reasons for the sharp drop in drilling costs was the intense competition in the industry due to the excess capacity. An indicator of excess capacity is the rig utilization rate. The size of the rig fleet moved up with oil prices, increasing from 1,767 rigs in 1973 to 5,644 rigs in 1982. Based on the annual average number of rotary rigs running, the rig utilization rate moved up from 52.5% in 1971 to 81.9% in 1975. The rate stayed in the 68% to 80% range from

1976–1980 and moved up to 82.7% in 1981.

The rig fleet was still growing in 1982 as rig activity was falling, and the utilization rate plummeted to 55%. The size of the rig fleet fell to 5,273 in 1983, but activity fell faster, and the utilization rate dropped to 42.3%. The total rig fleet fell to 4,580 in 1984, and the utilization rate moved up to 53%. In 1985, the rig fleet still stood at 4,409, but the number of active rigs fell to 1,980, resulting in a utilization rate of 44.9%. This low rate continues to put downward pressure on drilling costs.

The size of the rig fleet has not dropped as fast as the number of active rigs.

With declining drilling costs offsetting the drop in oil prices, the economics of drilling activity improved slightly between 1982 and 1985. The cost of drilling and equipping a well in 1985 was down 40% from the peak. The average wellhead price of crude oil in 1985 was



RIG UTILIZATION

	Reed rotary rig census	Hughes active rig count	% utilization rate
1974	1,894	1,471	77.7
1975	2,028	1,660	81.9
1976	2,204	1,658	75.1
1977	2,482	2,001	80.6
1978	2,851	2,255	79.1
1979	3,182	2,176	68.4
1980	3,672	2,910	79.2
1981	4,803	3,970	82.7
1982	5,644	3,105	55.0
1983	5,273	2,232	42.3
1984	4,580	2,428	53.0
1985	4,409	1,980	44.9

Source: Reed Tool Co.; Hughes Tool Co.

WELL COST AND OIL PRODUCTION

Year	Average cost per well ($)	Wellhead price of oil ($/bbl)	Barrels of oil to cover well cost
1970	94,885	3.18	29,838
1971	94,708	3.39	29,937
1972	106,424	3.39	31,394
1973	117,152	3.89	30,116
1974	138,718	6.74	20,581
1975	177,793	7.56	23,518
1976	191,615	8.19	23,396
1977	229,181	8.57	26,742
1978	279,950	9.00	31,106
1979	331,367	12.64	26,216
1980	367,682	21.59	17,030
1981	453,691	31.77	14,280
1982	514,378	28.52	18,036
1983	371,721	26.19	14,193
1984	326,463	25.88	12,614
1985E	306,580	24.08	12,732

E-Estimate

Source Department of Energy and API 1970-1984. Author's estimates 1985

TOTAL U.S. SUPPLY OF TUBULAR GOODS

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Tubular goods (Thous tons)											
Mill shipments	2,577	1,678	2,405	2,647	2,458	3,612	4,453	1,760	696	1,455	1,324
Less exports	430	169	140	155	285	133	128	153	61	53	60
Plus imports	217	219	487	591	457	1,036	2,389	2,180	565	2,214	1,495
U.S. supply	2,364	1,728	2,752	3,083	2,630	4,515	6,714	3,787	1,200	3,616	2,759
Footage drilled (Thous ft)	181,040	187,290	215,696	238,386	243,685	311,445	406,520	375,383	316,617	368,336	319,993
Tons tubular goods Per thous ft	13	9.2	12.8	12.9	10.8	14.5	16.5	10.1	3.8	9.8	8.6

Source IPAA

RIG EFFICIENCY, WELLS DEEPER THAN 2,500 FT

Year	Rig count	Wells	Footage (Million)	Wells/rig	Footage/rig	Ft/well (Avg. depth)
1970	1,028	20,146	127.8	19.6	124,364	6,346
1971	976	18,226	116.4	18.7	119,260	6,386
1972	1,107	19,990	127.6	18.1	115,270	6,383
1973	1,194	20,464	129.1	17.1	108,120	6,309
1974	1,471	22,736	139.3	15.5	94,700	6,127
1975	1,660	27,140	164.4	16.3	99,040	6,057
1976	1,656	28,003	168.7	16.9	101,750	6,024
1977	2,001	32,803	196.8	16.4	98,350	5,999
1978	2,255	36,149	218.5	16.0	96,720	6,044
1979	2,176	36,096	221.1	16.5	101,560	6,125
1980	2,910	46,903	279.7	16.1	96,120	5,963
1981	3,970	62,009	368.8	15.6	92,800	5,948
1982	3,105	56,490	338.6	18.2	109,043	5,994
1983	2,232	48,357	280.7	21.7	125,775	5,805
1984	2,428	56,808	330.6	23.4	136,160	5,820
1985	1,980	48,472	285.9	24.5	144,390	5,898

ROTARY RIGS RUNNING — BY STATES

Record high and low

State	Rig count 12-28-81	Rig count 7-14-86	Change 86-81	% change 86/81
Alabama-Land	20	3	17	85.0
Alabama-Offshore	3	2	1	33.3
Total Alabama	23	5	18	78.3
Alaska-Land	27	11	16	59.3
Alaska-Offshore	0	1	1	—
Total Alaska	27	12	15	55.6
Arkansas	42	7	35	83.3
California-Land	151	35	116	76.8
California-Offshore	25	2	23	92.0
Total California	176	37	139	79.0
Colorado	93	10	83	89.2
Florida-Land	4	1	3	75.0
Florida-Offshore	1	0	1	100.0
Total Florida	5	1	4	80.0
Georgia	0	1	1	—
Hawaii	1	0	1	100.0
Idaho	3	1	2	66.7
Illinois	105	5	100	95.2
Indiana	8	1	7	87.5
Kansas	214	33	181	84.6
Kentucky	15	3	12	80.0
N. Louisiana	54	8	46	85.2
S. Louisiana-Inl Water	87	13	74	85.1
S. Louisiana-Land	175	38	137	78.3
S. Louisiana-Offshore	168	44	124	73.8
Total Louisiana	484	103	381	78.7
Michigan	40	16	24	60.0
Mississippi	79	13	66	83.5
Montana	73	2	71	97.3
Nebraska	18	2	16	88.9
Nevada	2	2	0	—
New Mexico	160	11	149	93.1
New York	21	2	19	90.5
N. Dakota	123	10	113	91.9
Ohio	94	15	79	84.0
Oklahoma	871	99	772	88.6
Pennsylvania	38	15	23	60.5
Rhode Island—Offshore	3	0	3	100.0
S. Dakota	1	0	1	100.0
Tennessee	1	0	1	100.0
Texas-Offshore	78	15	63	80.8
Texas-Inl Water	0	1	1	—
District 1	38	4	34	89.5
District 2	122	11	111	91.0
District 3	220	22	198	90.0
District 4	133	26	107	80.5
District 5	32	9	23	71.9
District 6	144	18	126	87.5
District 7B	88	14	74	84.1
District 7C	99	9	90	90.9
District 8	206	30	176	85.4
District 8A	97	25	72	74.2
District 9	103	16	87	84.5
District 10	91	11	80	87.9
Total Texas	1,451	211	1,240	85.5
Utah	60	6	54	90.0
Virginia	3	6	3	100.0
Washington	3	0	3	100.0
W. Virginia	65	13	52	80.0
Wyoming	228	21	207	90.8
Total United States	**4,530**	**663**	**−3,867**	**−85.4**
Canada	262	68	194	74.0
Canada-Offshore	5	6	1	20.0
Grand Total	**4,797**	**737**	**−4,060**	**−84.6**

Source: Hughes Tool Company

ROTARY RIG ACTIVITY BY STATES

	1985		Average rig activity									
	Low	Peak	1985	1984	1983	1982	1981	1980	1979	1978	1977	1976
Alabama	14	30	22.3	15.5	15.2	15.3	17.3	10.8	12.6	12.5	13	17
Alaska	15	26	20.2	14.1	13.8	21.6	23.5	13.8	13.5	15.5	15	14
Arizona	0	1	0.3	0.2	0.3	1.0	1.1	1.0	0.0	0.4	1	1
Arkansas	12	35	24.3	26.1	25.9	27.0	33.9	26.8	10.4	13.9	15	15
California	65	129	80.8	107.2	105.7	128.8	154.8	120.2	95.6	94.1	89	89
Inland	55	111	68.8	89.2	83.4	106.2	133.7	104.7	85.7	86.3	81	85
Offshore	8	20	12.0	18.0	22.3	22.6	21.1	15.5	9.9	7.8	8	4
Colorado	31	66	49.9	53.9	52.2	60.3	81.6	61.1	40.2	41.1	45	38
Florida	4	13	6.8	3.6	4.4	4.6	7.8	4.1	5.3	6.3	6	5
Idaho	0	3	1.3	0.8	1.2	1.5	3.2	2.6	1.8	3.2	1	1
Illinois	6	47	28.5	41.5	60.2	75.5	42.9	25.4	13.1	28.4	16	22
Indiana	1	7	3.7	6.6	5.9	7.1	1.2	0.1	0.3	4.4	3	2
Kansas	54	123	91.7	127.6	124.1	157.4	196.2	120.2	66.0	75.5	67	51
Kentucky	3	10	6.3	8.1	8.4	9.5	5.3	1.7	0.4	3.3	2	1
Louisiana	243	356	283.1	309.9	283.6	343.1	455.6	427.4	347.0	338.3	292	231
North	9	41	24.5	30.3	29.4	39.9	58.0	54.9	34.5	39.8	45	34
Inland waters	33	57	43.7	51.4	47.1	59.2	83.2	76.6	62.1	62.5	57	49
South	73	112	85.6	96.1	81.9	107.8	160.3	156.4	112.3	113.9	81	65
Offshore	114	154	129.3	132.3	125.2	136.2	154.1	139.4	138.1	122.1	109	83
Maryland	0	0	0	0.0	0.0	0.0	0.6	0.2	0.5	0.7	0	1
Michigan	7	45	34.0	34.1	29.1	31.4	36.5	30.7	25.1	24.0	24	24
Mississippi	21	42	31.0	32.4	32.8	41.6	71.5	57.6	40.2	44.5	42	32
Montana	14	33	22.8	36.0	23.9	36.2	81.4	49.2	32.9	30.1	27	28
Nebraska	3	12	6.5	9.1	9.0	9.4	15.0	14.3	9.2	9.6	9	8
Nevada	2	11	5.0	5.0	1.1	3.0	4.9	4.6	4.1	2.9	3	2
New Mexico	57	84	71.3	77.8	65.0	103.3	134.9	117.6	87.5	75.5	70	54
New York	0	14	5.2	8.9	10.2	15.1	11.6	7.0	8.7	7.0	6	9
North Dakota	24	54	38.9	50.9	42.5	69.4	118.8	83.4	56.5	39.1	24	19
Ohio	7	70	29.5	51.1	39.3	56.8	97.8	73.7	46.3	45.6	33	26
Oklahoma	204	303	251.0	319.2	285.5	621.5	698.4	397.3	246.7	258.2	233	186
Pennsylvania	7	49	30.2	35.5	22.0	32.6	38.6	29.0	28.9	25.2	15	10
Rhode Island offshore	0	0	0.0	0.0	0.0	2.4	2.0	2.1	4.0	4.3	1	0
South Dakota	0	7	1.7	2.2	1.0	1.5	2.2	1.9	1.4	2.3	3	2
Texas	583	890	679.8	850.1	797.5	989.6	1,317.0	987.7	770.2	855.0	799	653
Gulf Coast	83	157	102.1	138.1	133.9	169.0	305.2	210.5	141.3	197.0	175	160
Offshore & inland waters	33	71	52.1	60.1	56.2	88.3	74.5	72.1	50.3	46.9	42	36
North	60	104	82.7	99.6	125.0	138.1	170.7	147.2	122.4	153.2	142	111
Panhandle	28	56	37.4	49.9	48.3	66.2	66.6	50.8	48.1	60.4	42	37
East	56	99	77.0	102.1	102.2	115.7	163.9	119.8	107.0	116.6	73	54
West Central	62	116	87.1	124.5	102.7	139.8	191.6	140.4	109.4	117.2	136	101
West	207	304	241.3	276.9	229.2	272.5	344.5	247.1	191.7	163.7	169	154
Utah	20	49	28.8	45.3	36.8	39.8	69.2	42.4	28.9	32.1	30	19
W. Virginia	14	38	26.0	37.7	33.9	49.4	44.8	37.8	29.8	27.1	17	12
Wyoming	74	137	92.7	114.6	95.6	142.7	191.3	155.5	147.2	136.4	118	86
Others	0	10	5.5	3.2	5.0	6.5	8.6	3.3	2.9	2.0	2	0
Total U.S.	**1,821**	**2,576**	**1,980.0**	**2,428.2**	**2,232.3**	**3,104.9**	**3,969.5**	**2,910.3**	**2,177.2**	**2,258.8**	**2,001**	**1,658**
Canada	99	431	303.7	245.3	109.3	195.0	258.6	396.8	334.6	270.2	217	177
Canada offshore	5	12	9.3	13.7	10.4	5.4	4.8	4.7	4.1	1.5	1	2
Grand total	**1,950**	**2,863**	**2,293.0**	**2,687.2**	**2,433.0**	**3,305.3**	**4,232.9**	**3,311.8**	**2,515.9**	**2,530.5**	**2,219**	**1,837**

Source: Hughes Tool Co. Note: Columns may not add due to independent rounding.

$24.08/bbl, down 24.2% from the peak. The profit margin improved, compared to the margin at the height of the drilling boom.

Another way of illustrating the improved economics is by comparing the volume of oil required to cover the average cost of a well. From 1970 to 1979, the number of barrels of oil that needed to be produced to cover the average cost of a well ranged from a low of 20,581 to a high of 31,394. This fell to 14,193 barrels in 1983, and only 12,614 in 1984. It rose very slightly to 12,732 in 1985, based on estimated well costs. Even though the probability of finding oil may have decreased, the amount needed to recover costs has fallen sharply.

The number of producing wells in the U.S. has been increasing along with the massive number of well completions. It reached an estimated 885,077 at year-end 1985. The higher oil and gas prices have helped lengthen the life of old wells and slowed abandonments, but with the sharp break in prices in 1986, this situation is changing. At these lower prices, abandonments will increase substantially.

The vast majority of U.S. operating oil wells are artificial lift wells. Over the period 1976–1984, the number of flowing wells has changed little. The number of flowing wells was 32,969 in 1976. This dropped to 31,927 in 1978 and then rebounded, moving up to 38,000 in 1981. At the end of 1985, it was estimated that there were 37,665 flowing wells. The number of artificial lift wells has increased steadily from 470,299 in 1976 to 609,070 wells in 1985. The total number of oil wells was 646,735 at year-end 1985.

Outlook

Wellhead revenues and the reinvestment ratio will increase over the forecast period.

Lower crude oil and natural gas prices will substantially reduce wellhead revenues in 1986. Total wellhead realizations will drop to $86,000 million, down 26.6%. In addition, because of the pessimism in the industry, the reinvestment ratio will fall to the lowest level in the past 25 years, to 14%. This will result in a substantial reduction in drilling outlays and rig activity.

Drilling expenditures in 1986 will drop to $12,040 million, down 40% from 1985. The number of active rotary rigs will average around 1,000 for the year, a drop of 49.5%. Well completions will drop to 46,420, a dip of 38%, and total footage drilled will drop to 199 million, down 37.6%.

The good news is that 1986 will be the low point, and conditions in the U.S. exploration and drilling industry should improve over the forecast period, 1986–1991.

Total wellhead revenues are expected to slip even further in 1987, to $80,160 million, down another 6.8%. However, this is expected to be more than offset by an improvement in the reinvestment ratio to 16.1%. Therefore, total drilling expenditures will actually increase 7% to $12,880 million.

The activity level will also get a boost from a further decline in drilling costs, to an average well cost of $268,610 in 1987. This is 47.8% below the peak in 1982. The combined effect will be an increase in average active rigs to 1,070 in 1987, and an increase in well completions to 47,950. These are marginal improvements, but indicate a changing climate in the domestic oil and gas industry.

As the prices of crude oil and natural gas continue to increase throughout the remainder of the forecast period, 1988–1991, the activity level will continue to rise. Total wellhead revenues will increase steadily to $96,260 million in 1991, up 11.9% from 1986.

The reinvestment ratio will improve substantially as investment money returns to the domestic oil industry. The ratio will increase to

22.2% in 1991. Therefore, drilling expenditures will increase 77.5% over the forecast period, to $21,370 million in 1991.

The rig count will move up with spending, increasing 76% to 1,760 in 1991. Well completions, however, will not increase as rapidly, due to a shift to deeper drilling. Well completions will increase 42.7% to 66,250 in 1991.

The average well cost will begin to move up again, but some overhanging excess capacity and stiff competition will hold the increase down to a rate similar to the increase in wellhead revenues. The average cost per well will move up 11.9% to $322,550 in 1991.

The measures of drilling rotary rig efficiency, wells per rig and footage per rig, jumped sharply in recent years. These indicators will decline over the forecast period with a shift to deeper well drilling. This is an attempt to find more economically attractive reservoirs. The average well depth was 4,271 feet in 1985. It is estimated at 4,300 feet in 1986. This will move up steadily to 4,650 feet per well in 1991, an increase of 8.1%. Total footage drilled is expected to increase to 308.1 million in 1991, up 54.3%.

As a result of this shift in emphasis, the number of wells drilled per rotary rig will peak in 1986 at 46.4. It will decline to 37.6 wells per rig in 1991. Footage drilled per rig will also peak in 1986, at 199,600 feet. It wil decline 12.3% to 175,040 feet in 1991. These numbers indicating rig efficiency are inflated by a substantial amount of non-rotary rig activity.

With the lower oil prices, abandonments are expected to be much higher, peaking in 1987 at 43,590 wells. But the number of active producing wells is still expected to increase over the forecast period, to 987,640 total producing wells at the end of 1991.

With the sharp drop in crude oil prices in 1986, the number of barrels of oil needed to cover the cost of a well shot up sharply. It jumped 67.7% to 21,347 barrels in 1986, from 12,732 in 1985.

The economics are expected to improve steadily over the forecast period. The number of barrels of production required to meet drilling costs will drop to 17,330 in 1987 and down to 15,002 barrels in 1991.

The rig count and well completions will move up after hitting a low in 1986.

THE OUTLOOK — EXPLORATION & PRODUCTION

	1986	1987	1988	1989	1990	1991	Change 1986 to 1991	% change 1986 to 1991
DRILLING ACTIVITY								
Active rotary rigs	1,000	1,070	1,140	1,270	1,600	1,760	+ 760	+ 76.0
Well completions	46,420	47,950	49,910	54,540	64,120	66,250	+ 19,830	+ 42.7
Footage drilled (thousands)	199,600	210,980	224,600	248,160	291,750	308,060	+ 108,460	+ 54.3
Av. well depth	4,300	4,400	4,500	4,550	4,600	4,650	+ 350	+ 8.1
Wells/rig*	46.4	44.8	43.8	42.9	40.1	37.6	8.8	19.0
Footage/rig*	199,600	197,200	197,020	195,400	182,340	175,040	24,560	12.3
REVENUE AND COST								
Av. well cost ($)	288,180	268,610	274,710	281,640	302,250	322,550	+ 34,370	+ 11.9
Total wellhead revenue ($ million)	86,000	80,160	81,980	84,050	90,200	96,260	+ 10,260	+ 11.9
Total drilling expenditures ($ million)	12,040	12,880	13,710	15,360	19,380	21,370	+ 9,330	+ 77.5
% of revenue invested in drilling	14.0	16.1	16.7	18.3	21.5	22.2	—	—
PRODUCTION								
Capital expenditures ($ million)	2,650	2,840	3,020	3,380	4,270	4,710	+ 2,060	+ 77.7
Producing wells (Dec 31st)	894,100	898,460	907,420	923,350	952,820	987,640	+ 93,540	+ 10.5
Wells abandoned	37,397	43,590	40,950	38,610	34,650	31,430	—	—

*Per active rotary rig

REFINING/PETROCHEMICALS

REFINING/PETROCHEMICALS

THE U.S. AND worldwide refining industry has gone through a prolonged period of adjustment; one which is actually still continuing. It has gone through a period of adjustment or cycle that differed from the cycle in the upstream sector of the industry.

Making additional refining capacity available to meet demand requires a considerable lead time for planning and construction. When demand was rising rapidly in the 1970s, refining capacity was being added accordingly. Expectations were for a continuing increase in demand worldwide and in the U.S. When prices shot up over the 1979–1981 period, demand peaked and started to decline, but refining capacity was still increasing. Part of the continued expansion in capacity occurred because the initial downturn in demand was thought to be temporary.

With demand falling and refining capacity on the rise, a large excess refining capacity developed in the U.S. and worldwide. With excess refining capacity, refining margins and profits fell sharply. While earnings from exploration, drilling and production activities were substantial, the refining sector was experiencing a period of sparse earnings and even losses for some operations.

Refining capacity was reduced in accordance with long-range expectations of a lower level of demand. Financial conditions in the industry improved slowly as refining capacity fell. Recently the refining sector received a big boost as crude oil prices began to fall sharply. This lowered feedstock costs and enabled refiners to increase margins, but the biggest boost to refining profitability came with the introduction of net-back contracts. These contracts virtually locked in a profit margin for refiners, as the shift in product prices was passed through to the crude producer under the net-back terms. As more of these types of contracts were introduced, refiners found themselves in a substantially improved financial position.

Review

Demand for petroleum products in the U.S. increased 8.9%, from 17.308 million b/d in 1973 to 18.847 million b/d in 1978. Over this period, United States refining capacity moved up from 13.7 million b/d in 1973 to 18.6 million b/d in 1981, an increase of 4.9 million b/d or 36.2%. During that period, capacity was expanding to meet increasing actual demand and to meet expected future demand. The number of plants operating increased from 253 in 1973 to 315 in 1981. Total plants moved up from 281 to 324. The number of available plants shut down was reduced from 28 in 1973 to 9 in 1981.

Refining capacity continued to increase through 1981 even though demand peaked in 1978.

Although refining capacity continued to increase through 1981, demand had peaked in 1978. Demand for petroleum products in the U.S. fell for 5 consecutive years in response to the massive price increases of mid- and late 1970s. Demand fell 3.616 million b/d, 19.2%, to 15.231 million b/d in 1983.

The refining industry in 1980 and 1981 was still operating under the guidance of a long-term outlook that foresaw increasing demand. However, crude runs peaked in 1979 along with demand for petroleum products. But capacity continued to increase through 1981. Subsequently, the utilization rate, which was as high as 90.9% in 1973, and averaged 86.6% from 1973 to 1979, dropped to 75% in 1980.

As demand continued to fall, the rate dropped to extremely unprofitable levels of utilization below 70%: 67% in 1981, 65.8% in 1982 and 69.3% in 1983. Excess capacity ranged from 1.2 million b/d to 2.8 million b/d between 1973 and 1979. This jumped up to 4.5 million b/d in 1980 and 6.1 million b/d in 1981 and 1982.

The drop in demand resulted in a change in the perception of the longer-range trend in product demand, and there has been a substantial change in the long-range forecasts of petroleum product demand. Expectations of increases parelleling the long-range growth in economic activity of 3–4%/year have been put to rest. Long-range forecasts now call for very limited growth in demand through the year 2000. These forecasts may, in the long run, prove to be as far off the mark as the earlier optimistic outlook. But refiners realized that the lower demand levels experienced were not a temporary phenomenon, and they realized that they could not simply wait for demand to

Excess refining capacity resulted in a utilization rate that fell to 65.8% in 1982.

U.S. REFINERY CAPACITY AND UTILIZATION

	—— Number of plants* ——			Total capacity†	Crude runs	Utilization rate	Excess capacity
	Operating	Shut-down	Total	— (1,000 b/d) —		(%)	(1,000 b/d)
1973	253	28	281	13,671.4	12,431	90.9	1,240.4
1974	257	27	284	14,361.5	12,133	84.5	2,228.5
1975	262	28	290	14,960.7	12,442	83.2	2,518.7
1976	265	22	287	15,236.6	13,416	88.1	1,820.6
1977	273	18	291	16,398.4	14,605	89.1	1,793.4
1978	290	12	302	17,047.7	14,739	86.5	2,308.7
1979	301	10	311	17,440.9	14,646	84.0	2,794.9
1980	311	8	319	17,988.1	13,482	74.9	4,506.1
1981	315	9	324	18,620.5	12,471	67.0	6,149.5
1982	254	47	301	17,889.7	11,774	65.8	6,115.7
1983	233	25	258	16,859.3	11,685	69.3	5,174.3
1984	214	33	247	16,137.1	12,044	74.6	4,093.1
1985	199	24	223	15,658.8	12,002	76.6	3,656.8

*As of January 1. †As of January 1. Includes operating and operable shutdown

Source: Energy Information Administration, American Petroleum Institute

REFINERY CASH OPERATING MARGINS

Gulf Coast average (dollars per barrel)

Year	Margins
1975	−0.47
1976	0.26
1977	0.60
1978	0.53
1979	1.47
1980	1.55
1981	0.30
1982	1.05
1983	−0.03
1984	−0.72
1985	0.35

Source: Wright Killen & Co

REFINERY RUNS BY DISTRICTS

	1976	1977	1978	1979	Crude runs 1980	1981	1982	1983	1984	1985
	—	—	—	—	1,000 b/d	—	—	—	—	—
East Coast	1,415	1,496	1,537	1,478	1,296	1,202	1,103	960	1,019	1,061
Appalachian Dist. 1	170	178	180	167	158	132	93	77	87	92
Total Dist. 1	1,585	1,674	1,717	1,645	1,454	1,334	1,196	1,037	1,106	1,153
Appalachian Dist. 2	62	65	60	65	51	54	51	53	58	60
Ill., Ind., Ky.	2,286	2,406	2,425	2,353	2,063	1,803	1,714	1,798	1,784	1,777
Minn., Wisc., Dak.	257	267	279	294	238	229	251	253	282	285
Okla., Kan., Mo.	995	1,040	1,044	1,017	943	883	763	642	636	617
Total Dist. 2	3,600	3,778	3,808	3,729	3,295	2,969	2,779	2,746	2,760	2,739
Texas:										
Inland	462	477	476	472	445	469	456	474	499	472
Gulf Coast	3,102	3,442	3,524	3,462	3,142	2,829	2,726	2,801	2,780	2,750
Louisiana Gulf	1,903	2,158	2,140	2,167	2,085	2,030	1,941	1,862	2,012	1,972
N. La., Ark.	169	196	214	200	186	163	162	170	177	168
New Mexico	81	87	84	89	86	81	77	75	68	60
Total Dist. 3	5,717	6,360	6,438	6,390	5,944	5,572	5,362	5,382	5,536	5,422
Total Dist. 4	442	469	488	477	442	425	416	420	436	432
Total Dist. 5	2,072	2,324	2,288	2,405	2,347	2,171	2,021	2,100	2,206	2,256
Total U.S.	13,416	14,605	14,739	14,646	13,482	12,471	11,774	11,685	12,044	12,002

Source: Energy Information Administration

return and incur profit setbacks. The refining industry realized that a capacity adjustment to lower demand levels was required. Capacity would have to be reduced in order to increase the utilization rate, cut unit costs, and improve margins.

From the peak in 1981, average total distillation capacity moved down 15.9% to 15.7 million b/d in 1985. This was a capacity cut of 2.962 million b/d. The number of plants operating has fallen from 315 in 1981 to 199 in 1984, a drop of 116, and the number of total plants is down from 324 to 223, off 101. There now 24 plants temporarily shut down. Many plants have been closed permanently.

The refining industry had historically operated in an atmosphere of ever-expanding refining capacity in response to demand for products. Adjusting their planning process to accommodate a shrinking industry was difficult. But a leaner, more efficient industry was essential if refinery margins were to improve. Further adjustments to refining capacity will depend upon the refiners' expectations of future demand for petroleum products.

Lowering total capacity has helped boost the utilization rate to 85%.

Presently, operable capacity is about 15.5 million b/d and with increased demand the utilization rate is around 85%. Refiners prefer a rate of 85-90%, and increased demand may maintain the utilization rate at this level in the near future. Therefore, there is not expected to be any drop in overall capacity.

The problems refiners face can best be seen in looking at the value of the refined barrel compared to the cost of crude and refining costs. The total value of the refined barrel went from $14.73 in 1977, prior to the second large price hike, to $39.07 in 1981. The refiners acquisition cost of crude moved up from $11.96 in 1977 to $35.24 in 1981. Between 1977 and 1981, the net value to the refiner after subtracting refining costs was generally positive, averaging about $0.89/bbl. However, rapidly rising crude oil costs, coupled with rising refining costs as the utilization rate fell, turned net margins negative. Margins have fluctuated over the past few years, but falling product sales and high unit costs due to the low capacity utilization rate kept margins generally low or negative.

Refining cash operating margins turned positive in 1985 with lower crude costs, and margins have been better in early 1986 with netback contracts, much lower crude costs and high utilization rates.

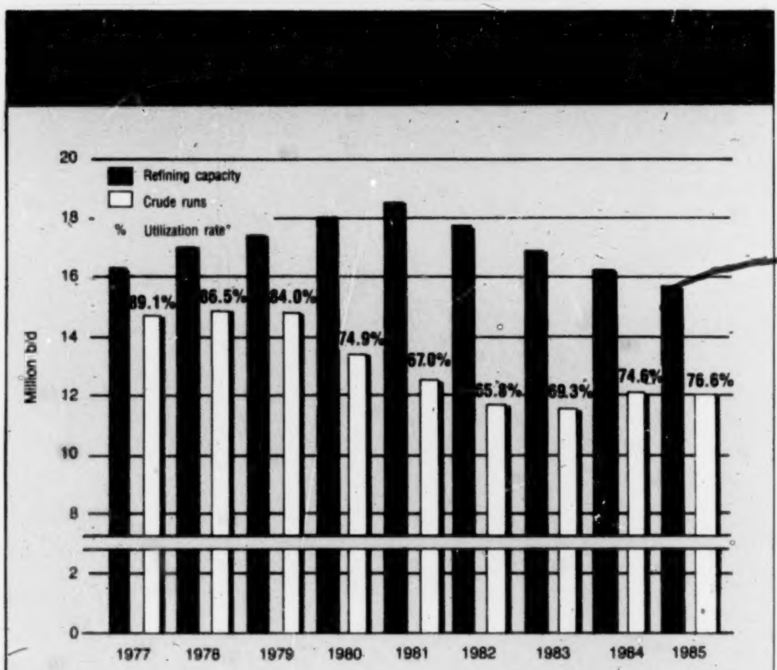
Even with the excess capacity situation, capital expenditures for refining facilities remained relatively high over the 1981–1985 period. A substantial portion of this was for upgrading capacity to handle cheaper, but heavier, crude, and investment to enable production of a greater yield of lighter products. As overall distillation capacity was falling, upgrading capacity was increasing.

It is expected that world crude oil will continue to get heavier and have a greater sulfur content. The API weight of crude processed by U.S. refiners will move from about 32.6 at present to 31.8 in 1985 and 31.1 in 1990. The average sulfur content will go from about 0.96% to 1.07% in 1985 and 1.18% in 1990.

Illustrative of the shift to a greater demand for lighter products is the shift in resid and gasoline. In 1977, resid demand represented 16.7% of the demand barrel, and gasoline 38.9%. By 1985, this had shifted to resid only 7.6% and gasoline 43.4%.

Demand for lighter products continues to increase requiring greater investment in conversion facilities.

The ability to handle the heavier crude and upgrade the output so as to produce a greater yield of lighter products is essential for long-term profitability in the refining industry. Even though resid demand is expected to increase, over the long term lighter products will be the most profitable for refiners.



	1977	1978	1979	1980	1981	1982	1983	1984	1985
Refining capacity	16.4	17.0	17.4	18.0	18.6	17.9	16.9	16.1	15.7
Crude runs	14.6	14.7	14.6	13.5	12.5	11.8	11.7	12.0	12.0

*Crude runs as percent of capacity.
Source: Energy Information Administration; American Petroleum Institute

The chemical/petrochemical industry activity closely follows the growth pattern of the overall economy. It has also been faced with an excess capacity situation worldwide, and additional capacity has been added recently in the Middle East, making the worldwide industry more competitive. The industry slipped in 1982 after steady growth from 1975 through 1981, but rebounded in 1983 and continued to grow in 1984 and 1985. According to the Chemical Manufacturers Association, the value of total U.S. chemical shipments increased 2.9% in 1985 to $217.4 billion. Shipments in 1984 were $211.31 billion, up 11.7% from 1983. Shipments in 1983 were up 9.5%, following a drop of 4.3% in 1982.

The increase in the value of shipments in 1985 was mainly due to a slight increase in prices. Production volumes were at the same level as 1984, while prices moved up 0.7%. The operating rate increased to 78.2% in 1985, from 72.3% in 1984. The rate had fallen to 66% in 1982. The shutdown of a number of plants helped boost the overall utilization rate of remaining capacity.

The U.S. industry's worldwide competitive position continues to deteriorate. Exports in 1985 were about the same as 1984 at $22 billion, but imports were up 6% to a record $14.6 billion.

Demand for petrochemicals is rising but so is competition from energy-rich countries.

Demand for petrochemicals has been increasing in recent years, but overcapacity and competition from energy-rich countries have had a negative impact on margins. As feedstock costs and other operating costs increased, they became a greater percentage of total costs. The margins have been reduced, and with overcapacity worldwide there is substantial competition. But with these reduced operating margins, price cutting is no longer an effective competition tool. Volumes cannot be increased to make up for the loss of revenue. Therefore, the industry is looking for ways to cut costs.

It appears that there are two basic approaches to cost cutting. One is to locate the plants closer to the feedstocks. The other approach is to improve the efficiency of plants and obtain more products per unit of feedstock. Either approach requires substantial investment in petrochemical facilities, and spending has remained high over the past several years.

Outlook

Total U.S. refining distillation capacity is expected to slip to 15.5 million b/d in 1987, but then climb slowly throughout the remainder of the forecast period. With demand and crude runs up in 1987, the overall refinery utilization rate will be 84.5% in 1987.

Capacity will increase marginally during the forecast period to satisfy rising demand.

Refining capacity will increase to 16.1 million b/d in 1991, up 3.7% from 1986. This increase will be less than the rate of increase in demand and refinery inputs. As a result, the refinery utilization rate will move up to 85% in 1988 and 85.3% in 1991.

Modernization and upgrading will require additional capital investment.

With substantial refining capacity worldwide, product imports are also expected to increase throughout the forecast period. Product imports will increase 6.7% to 2.07 million b/d. Capital spending in the refining industry will move up throughout the 1986–1991 period. A substantial portion will go for the increased capacity as well as modernization and upgrading capacity. Capital spending will increase 35.2% to $2,590 million. Capital spending by U.S. oil companies on petrochemical facilities is expected to increase 23.3% from 1986–1991. Petrochemical spending will move up to $1,510 million in 1991. Spending would be higher, but the competitive threat from the foreign export facilities is producing some caution.

The future for the industry is favorable. Demand for petrochemicals is expected to grow at about 5% per year throughout the forecast period, but the U.S. industry and individual companies are facing stiff competition worldwide.

THE OUTLOOK — REFINING & PETROCHEMICALS

	1986	1987	1988	1989	1990	1991	Change 1986 to 1991	% change 1986 to 1991
U.S. domestic demand (thousand barrels/day)	16,190	16,515	16,720	16,895	17,100	17,300	+1,110	+ 6.9
U.S. refining capacity (thousand barrels/day)	15,520	15,500	15,600	15,700	15,900	16,100	+580	+ 3.7
Crude runs (thousand barrels/day)	12,655	12,910	13,070	13,210	13,380	13,550	+895	+ 7.1
Input to distillation units (thousand barrels/day)	12,840	13,100	13,260	13,400	13,570	13,740	+900	+ 7.0
Refinery utilization rate (%)	82.7	84.5	85.0	85.4	85.3	85.3	—	—
Product imports (thousand barrels/day)	1,940	1,980	2,005	2,025	2,050	2,070	+130	+ 6.7
CAPITAL SPENDING: ($ million)								
Refining	1,915	2,035	2,105	2,210	2,430	2,590	+675	+35.2
Petrochemical	1,225	1,305	1,355	1,400	1,470	1,510	+285	+23.3
PRICES:								
Refinery acquisition cost: ($/barrel)								
Domestic	15.45	17.45	18.40	19.40	21.80	23.60	+8.15	+52.8
Imported	15.60	17.60	18.65	19.65	22.20	24.50	+8.90	+57.1
Composite	15.50	17.50	18.50	19.50	22.00	24.00	+8.50	+54.8
Motor gasoline ($/gallon)	0.895	0.975	1.015	1.060	1.140	1.225	+0.330	+36.9
Distillate Fuel Oil (Home heating) ($/gallon)	0.790	0.860	0.895	0.935	1.010	1.100	+0.310	+39.2

TRANSPORTATION

TRANSPORTATION

THE DOWNTURN in demand for crude oil, petroleum products and natural gas in the U.S. had a substantial negative impact on activity in the transportation sector of the industry. To a smaller degree, this has also been true for worldwide transportation.

There has been a general decline in capital expenditures and volumes in transport in the U.S. over the past five years. Volumes of crude oil and product transported worldwide, and the size of the international transport fleet have also been declining over this period.

Transport activity includes water transport, surface transport by vehicles and trains, and pipeline transport. The level of activity is affected by both the volume being moved and the geographic location of production, refining and consuming markets. Because of this, shifting transport and distribution patterns can change transport activity levels even if volumes are relatively constant.

Review

The largest level of capital expenditures for transportation is for pipelines. And the major interest with respect to pipelines is new construction.

Between 1973 and 1982, total U.S. pipeline mileage increased from 419,464 miles to 459,548 miles. This was an increase of 40,084 miles, 9.6%. Gas pipeline mileage increased from 248,773 miles to 286,999 miles, an increase of 38,226 miles. The increase in gas pipelines accounted for 95.4% of the increase in total pipeline mileage. Liquids pipeline mileage was 172,549 miles in 1982, up only 1.1% from 170,691 miles in 1973. The change in total mileage does not reflect all total new construction. Some old pipelines are shut down each year so that new construction represents more than net additions.

Total pipeline mileage decreased along with demand for petroleum and natural gas.

Total interstate pipeline mileage in the U.S. peaked in 1982 at 459,548 miles. That was also the year of peak natural gas pipeline mileage of 286,999 miles, 62.5% of total mileage. Liquids pipeline mileage was 172,549 miles that year.

Since that time, gas pipeline and total mileage have fallen a fair amount, while liquids pipeline mileage has moved up. The latest year for which data is available is 1984, when total mileage was 432,401 miles, down 5.9%. Gas pipeline mileage was 258,379 miles, down 10%, and liquids pipeline mileage was 173,922 miles, up 0.8%. The peak year for mileage of liquids pipeline was 1976, with 174,072 miles.

These figures can also be a bit misleading with respect to pipeline construction activity. Even though total mileage has been declining, there has been ongoing construction activity.

New discoveries and changing distribution patterns require an ever-changing pipeline network. Pipelines are added to new or expanding producing areas, and are shut down as areas are depleted. Population growth and shifts require new distribution pipelines.

Pipeline expenditures reflect changing demand and supply patterns.

Pipeline expenditures are a representation of the industry's perception of future long-term needs. Most pipeline projects are of a long

TOTAL CRUDE PETROLEUM AND PETROLEUM PRODUCTS CARRIED IN DOMESTIC TRANSPORTATION

By mode of transportation
(Billions of ton miles)

Year	Total crude and products ton miles	PIPELINES		WATER CARRIERS		MOTOR CARRIERS*		RAILROADS	
		Ton miles	Percent of total	Ton miles	Percent of total	Ton miles	Percent of total	Ton miles	Percent of total
1972	838.8	475.8	56.73	330.0	39.34	23.0	2.74	10.0	1.19
1973	843.6	507.0	60.10	296.8	35.18	25.0	2.96	14.8	1.76
1974	847.7	506.0	59.69	297.0	35.04	29.0	3.42	15.7	1.85
1975	846.7	507.0	59.88	298.0	35.20	27.6	3.26	14.1	1.66
1976	867.7	515.0	59.35	306.9	35.37	32.5	3.75	13.3	1.53
1977	923.4	546.0	59.13	333.3	36.09	29.6	3.21	14.5	1.57
1978	1,160.2	585.8	50.49	530.6	45.73	30.6	2.64	13.2	1.14
1979	1,174.8	608.3	51.78	522.9	44.51	30.1	2.56	13.5	1.15
1980	1,245.3	588.2	47.24	617.8	49.61	26.8	2.15	12.5	1.00
1981	1,218.4	563.7	46.27	617.2	50.66	24.9	2.04	12.6	1.03
1982	1,218.2	565.7	46.44	616.9	50.64	22.7	1.86	12.9	1.06
1983	1,223.5	556.1	45.45	630.5	51.53	25.1	2.05	11.8	.97
1984	1,180.2	568.1	48.14	570.7	48.36	29.2	2.47	12.2	1.03

TOTAL CRUDE PETROLEUM CARRIED IN DOMESTIC TRANSPORTATION

By mode of transportation
(Billions of ton miles)

Year	Total crude ton miles	PIPELINES		WATER CARRIERS		MOTOR CARRIERS*		RAILROADS	
		Ton miles	Percent of total	Ton miles	Percent of total	Ton miles	Percent of total	Ton miles	Percent of total
1972	362.0	284.5	78.6	76.0	21.0	1.0	0.3	0.5	0.1
1973	363.2	302.0	83.1	58.8	16.1	1.3	0.4	1.1	0.4
1974	358.9	303.0	84.4	53.0	14.3	1.3	0.4	1.6	0.4
1975	331.5	288.0	86.9	40.6	12.2	1.4	0.4	1.5	0.5
1976	343.8	303.0	88.1	37.8	11.0	2.1	0.6	0.9	0.3
1977	392.5	326.6	83.2	63.1	16.1	2.0	0.5	0.8	0.2
1978	623.5	359.5	57.7	261.3	41.9	2.0	0.3	0.7	0.1
1979	640.6	372.2	58.1	265.5	41.4	2.3	0.4	0.6	0.1
1980	753.0	362.6	48.2	387.4	51.4	2.5	0.3	0.5	0.1
1981	740.7	333.1	45.0	404.9	54.6	2.2	0.3	0.5	0.1
1982	770.2	335.1	43.5	432.7	56.2	2.0	0.2	0.4	0.1
1983	806.1	332.4	41.2	471.2	58.5	2.0	0.2	0.5	0.1
1984	748.4	333.0	44.5	412.6	55.1	2.2	0.3	0.6	0.1

TOTAL PETROLEUM PRODUCTS CARRIED IN DOMESTIC TRANSPORTATION

By mode of transportation
(Billions of ton miles)

Year	Total petroleum products ton miles	PIPELINES		WATER CARRIERS		MOTOR CARRIERS*		RAILROADS	
		Ton miles	Percent of total	Ton miles	Percent of total	Ton miles	Percent of total	Ton miles	Percent of total
1972	476.8	191.3	40.1	254.0	53.3	22.0	4.6	9.5	2.0
1973	480.4	205.0	42.7	238.0	49.5	23.7	4.9	13.7	2.9
1974	488.8	203.0	41.5	244.0	49.9	27.7	5.7	14.1	2.9
1975	515.2	219.0	42.5	257.4	50.0	26.2	5.1	12.6	2.4
1976	523.9	212.0	40.5	269.1	51.4	30.4	5.8	12.4	2.3
1977	530.9	219.4	41.3	270.2	50.9	27.6	5.2	13.7	2.6
1978	536.7	226.3	42.2	269.3	50.2	28.6	5.3	12.5	2.3
1979	534.2	236.1	44.2	257.4	48.2	27.8	5.2	12.9	2.4
1980	492.3	225.6	45.8	230.4	46.8	24.3	5.0	12.0	2.4
1981	477.7	230.6	48.3	212.3	44.4	22.7	4.8	12.1	2.5
1982	448.0	230.6	51.5	184.2	41.1	20.7	4.6	12.5	2.8
1983	417.4	223.7	53.6	159.3	38.2	23.1	5.5	11.3	2.7
1984	431.8	235.1	54.4	158.1	36.6	27.0	6.3	11.6	2.7

*Estimate

Source: Association of Oil Pipelines

duration and do not have an impact on immediate needs. Therefore, the relative level of spending is a good leading indicator of the expected changes in the level of activity in the oil and gas industry.

Capital spending on total U.S. pipeline construction increased from $672 million in 1972 to $7,390 million in 1982, an increase of 999.7% over the ten years. Spending on natural gas pipelines increased from $578 million in 1972 million in 1982, up 950.2%.

Crude and product pipeline outlays in 1982 were $1,320 million, up 1,304.3% from $94 million in 1972. Outlays for crude and product pipelines have been more volatile, reaching a peak of $2,949 million in 1976 when the Alaskan pipeline was under construction. More recently, spending reached $2,456 million in 1983.

But pipeline spending outlays have been coming down in recent years, for both crude and product pipelines and natural gas pipelines. Spending fell to a total of $3,221 million in 1985. Of this, $1,137 million was for crude and product pipelines, and $2,084 million was for natural gas pipelines.

Total pipeline construction plans for 1986 indicate an additional sharp drop in spending. Total planned spending in the U.S. is $1,744 million: crude and product pipelines, $435 million and natural gas pipelines $1,309 million.

Pipelines and water carriers moved 96.5% of the total.

Almost all natural gas is transported by pipeline, but crude oil and petroleum products are carried by a variety of modes of transport: pipeline, water carriers, motor carriers and railroads. The vast majority, however, is carried by pipeline and water carriers; 96.5% in 1984. Pipelines moved 48.14%, and water carriers 48.36% of the total ton miles.

Total ton miles of crude and products moved by all modes of domestic transport peaked in 1980 at 1,245.3 billion ton miles. This was up 48.5% from 1972. The total ton miles moved in 1984 was 1,180.2 billion ton miles, down 5.2% from the 1980 peak.

For crude oil carried in domestic transport, pipelines and water

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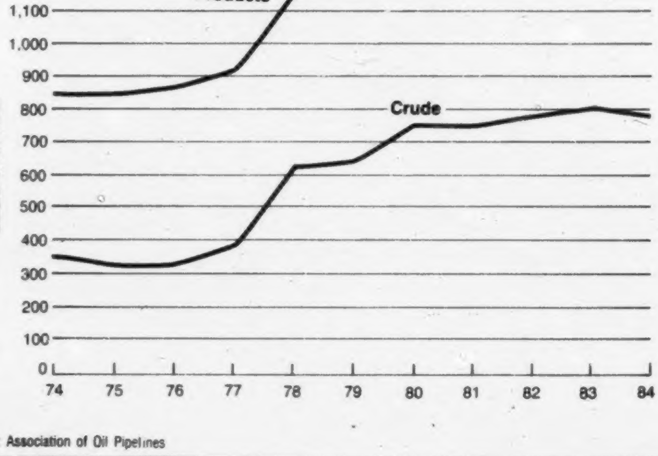


Source: Association of Oil Pipelines

carriers account for 99.6% of the total ton miles. Ton miles of crude transport peaked in 1983 at 806.1 billion ton miles, and then fell 7.2% to 748.4 billion in 1984.

Total ton miles of petroleum products carried in domestic transport peaked in 1978, at 536.7 billion ton miles. That was the year of peak domestic demand. This was down to 431.8 ton miles in 1984, down 19.5%.

Pipelines and water carriers accounted for 91% of the transport. Railroads hauled 2.7% and motor carriers accounted for 6.3%. Much of the short-haul and smaller loads are by motor carrier.

Ocean-going tankers for the transportation of crude can also represent huge investments. But in today's market, with substantially reduced demand, and therefore reduced import/export volumes, there is a massive surplus of tanker tonnage.

The domestic industry also uses water carriers for a substantial

PIPELINE CONSTRUCTION—1986 AND BEYOND*

Area	†4-10 in.	12-20 in.	22-30 in.	Larger than 30 in.	Total
			Miles		
GAS PIPELINES					
U.S.	1,585	1,218	1 266	2,021	6,090
Canada	2,615	267	10	1,463	4,355
Latin America	890	1,711	1,825	237	4,663
Western Europe	4,308	1,858	627	1,165	7,958
Middle East	177	18	449	776	1,420
Africa	200	25	175	541	941
Asia-Pacific	231	1,220	733	410	2,594
Total gas	**10,006**	**6,317**	**5,085**	**6,613**	**28,021**
CRUDE PIPELINES					
U.S.	202	251	2,071	1,043	3,567
Canada	216	912	1,770	1,418	4,316
Latin America	145	1,046	522	31	1,744
Western Europe	59	113	—	—	172
Middle East	171	102	882	2,859	4 014
Africa	7	—	—	—	7
Asia-Pacific	362	79	188	187	816
Total crude	**1,162**	**2,503**	**5,433**	**5,538**	**14,636**
PRODUCT PIPELINES					
U.S.	391	835	426	—	1,652
Canada	256	75	—	—	331
Latin America	1,044	1,008	—	—	2,052
Western Europe	19	71	—	—	90
Middle East	226	86	—	—	312
Africa	187	—	—	—	187
Asia-Pacific	37	4	—	—	41
Total products	**2,160**	**2,079**	**426**	**—**	**4,665**
NON-COMMUNIST WORLD TOTALS					
Gas	10,006	6,317	5,085	6,613	28,021
Crude	1,162	2,503	5,433	5,538	14,636
Products	2,160	2,079	426	—	4,665
Total	**13,328**	**10,899**	**10,944**	**12,151**	**47,322**

*Projects planned and under way. †Includes some projects of less than 4 in.

Source: Oil & Gas Journal

OIL/WORLD TANKER FLEET, BY SIZE

(Million DWT)

	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1985 Share of total	% change 85/75
10-25,000 dwt	19.7	17.5	16.1	14.8	14.2	14.1	13.8	13.5	13.0	12.8	12.3	5.0	−37.6
25-45,000 dwt	28.8	27.3	26.6	24.6	24.2	24.6	26.0	27.2	27.4	26.3	25.8	10.5	−10.4
45-65,000 dwt	21.9	19.9	18.2	16.1	15.3	16.1	16.6	16.1	15.3	15.7	15.0	6.1	−31.5
65-125,000 dwt	51.2	54.4	54.2	50.8	51.2	52.5	55.4	51.8	48.4	46.2	44.4	18.0	−13.3
125-200,000 dwt	23.6	28.7	32.3	33.3	33.4	33.0	31.2	30.2	28.8	28.9	28.4	11.5	20.3
200-320,000 dwt	130.1	144.8	156.6	157.4	157.7	155.4	146.5	134.5	120.4	111.6	94.9	38.4	−27.1
320,000 dwt and over	16.1	28.1	28.5	31.5	31.9	29.1	30.7	30.4	29.9	28.2	26.0	10.5	61.5
Total World	291.4	320.7	332.5	328.5	327.9	324.8	320.2	303.7	283.2	269.7	246.8	100.0	−15.3

Source: British Petroleum

proportion of crude oil and product transport. But with reduced domestic demand, transport volumes have moderated in recent years, and this has reduced the need for additional investment.

Investment for other land transport and inland water transport represents smaller outlays and is less volatile. A reduction in expenditures due to lower demand has been offset somewhat by increased expenditures due to changing patterns of distribution.

Capital expenditures on other modes of transport also moved up rapidly, increasing from $175 million in 1972 to $895 million in 1981, up 411.4%. Outlays fell back to $458 million in 1985 and planned spending for other transport in 1986 was $414 million. Some of these outlays had been for ocean-going tankers for crude transport. When imports fell sharply, this had a negative impact on the tanker industry.

The total size of the tanker fleet dropped 25.8% between 1977 and 1985.

The worldwide tanker industry has been severely depressed in recent years as crude and products trade dropped sharply from the peak of 1978-1979. The tanker fleet fell from the peak of 332.5 million deadweight tons in 1977 to 246.8 million tons in 1985. This was a drop of 25.8%. Much of the existing tonnage is idle or under-utilized.

The adjustment took the shape of eliminating redundant VLCC tankers. They are used mainly for long-distance transport, and the long-haul volumes of crude from the Persian Gulf to the United States were cut sharply. The industry is now concentrating on smaller and more flexible tankers. To hold down losses, many excess tankers have been converted for other uses, such as offshore storage.

The development of the North Sea oil fields has also had substantial impact on the tanker industry. As these fields developed, Europe was transformed from long-haul tanker trade to short-haul. In the early and mid-1970s, Europe relied primarily on long-haul oil from the Persian Gulf. This oil moved in VLCC tankers through the Straits of Hormuz and around the Cape of Good Hope. With the North Sea fields, many of these tankers were no longer needed.

The picture may be changing for the tanker fleet as petroleum demand and imports increase, particularly in the U.S. United States import requirements appeared to be the real key to improvement in tanker needs. But profitability in the tanker industry will also depend on scrappage rates, which would reduce the overall size of the fleet and increase average utilization rates. There is still substantial excess capacity to be absorbed in the tanker industry.

Outlook

The latest survey of pipeline constructions plans, by the *Oil & Gas Journal*, indicates an additional 11,309 miles of pipeline are planned to be constructed in 1986 and beyond in the U.S. Natural gas pipelines will account for 53.9% of the additional mileage, with 6,090 miles. New crude oil pipelines will add 3,567 miles, 31.5% of the total. And new product pipelines will add 1,652 miles, 14.6% of the total.

Capital spending for transportation will increase 38% over the forecast period.

Although U.S. pipeline construction has fallen from the boom levels of 1981–1983, it is obvious that a substantial level of new construction is planned. The pipeline industry has also been required to adjust to changing expectations for the industry and changing requirements for pipeline transport. But demand for natural gas and crude oil are expected to increase during the forecast period and that will require additional pipelines.

Worldwide non-communist area construction plans are for a total of 47,322 additional miles of pipeline; 36,013 miles outside the U.S. Natural gas pipelines will total 28,021 miles with 21,931 miles outside the U.S. Crude pipeline new mileage planned worldwide is 14,636 miles, 11,069 miles outside the U.S. And construction plans call for 4,665 miles of product pipelines, 3,013 miles outside the U.S.

Total U.S. capital expenditures for pipelines will increase 45% over the forecast period to $2,160 million in 1991. This is up from $1,490 million in 1986.

Outlays for gas pipelines will increase $405 million, up 38.4% to $1,460 million. While spending on crude and product pipelines is expected to be $700 million in 1991, up 60.9%, from the low $435 million in 1986. Increased exploration and drilling activity, increased demand for petroleum products, and increased imports will all have an impact on supply patterns and therefore on pipeline construction.

Increased activity in all sectors will change supply patterns and will have an impact on pipeline construction.

U.S. capital expenditures for other transport needed by the industry will also be affected by increased activity and demand. But the majority of the outlays will be for replacement of existing transport. Capital outlays will increase about 8.6% to $380 million in 1991.

THE OUTLOOK — TRANSPORTATION

	1986	1987	1988	1989	1990	1991	Change 1986 to 1991	% change 1986 to 1991
CAPITAL SPENDING ($ million)								
Gas pipelines	1,055	1,085	1,100	1,175	1,390	1,460	+405	+38.4
Crude and product pipelines	435	480	530	580	640	700	+265	+60.9
Other transport	350	355	360	365	370	380	+ 30	+ 8.6
Total transportation	**1,840**	**1,920**	**1,990**	**2,120**	**2,400**	**2,540**	**+700**	**+38.0**

NATURAL GAS

NATURAL GAS

NATURAL GAS now finds itself in a very competitive energy market. In order to try to retain markets, the natural gas industry has had to become more aggressive in marketing as well as adjusting prices to meet the competition from other fuels.

Demand for natural gas has usually moved up or down with movements in the level of economic activity. But in certain areas and markets, natural gas had a cost advantage over competing fuels. This helped natural gas to maintain a base demand level. But as other energy costs moved up, natural gas prices began to rise slowly in the early 1970s and then skyrocketed between 1973 and 1982.

Natural gas prices continued to move up while prices of competing fuels were falling, during the 1981 to 1984 period. It became evident that natural gas was a part of the larger energy industry, and that at a high enough price level, gas ran into competition from other fuels. Natural gas lost market share due to the change in relative prices.

Higher natural gas prices stimulated exploration and drilling for natural gas, and deliverability increased. At the same time, higher prices led to conservation and increased competition from competing fuels. The result was the "gas bubble" or deliverability surplus as available supply increased and demand slipped.

The duration of the gas bubble has been difficult to predict. But falling prices and reduced exploration activity signal a possible rapid shrinking of the deliverability surplus.

The economics of the natural gas industry have been distorted by government involvement.

The economics of the natural gas industry have been distorted by the continuous government interference with the market mechanism via a vast array of controls and regulations.

The major reason for the present problem in the natural gas industry was the Natural Gas Policy Act (NGPA) enacted in 1978. This act gave the Federal Power Commission the power to determine natural gas price rates charged by interstate natural gas pipeline companies to gas utilities. Under NGPA almost all gas production, rather than only gas produced for the interstate market, was put under controls.

A complicated schedule of prices was established for gas. One of the major problems with the NGPA, and any attempt at government price controls, is that there is no sufficient self-correcting mechanism that allows for movement to equilibrium at a market clearing price.

The NGPA was founded on the assumption that government regulators/central planners could precisely forecast the demand and supply of natural gas and, therefore, the market clearing price. Controls coupled with problems arising from long-term contractual rigidities created a serious economic distortion in the industry.

There is presently an effort to remove some of these controls and correct the distortions in the industry so that natural gas will be able to adequately compete. Returning natural gas to a more market-oriented structure would lead quickly to a stronger, more efficient industry.

Review

Over the ten-year period 1973–1982, the average wellhead price of

UNITED STATES NATURAL GAS SUPPLY AND DEMAND

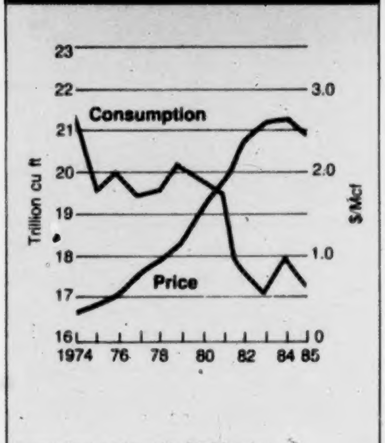
	Billion cu ft					
	1975	1980	1982	1983	1984	1985
Marketed production	20,109	20,180	18,520	16,822	18,230	17,218
Supplemental gas	0	155	145	132	110	134
Imports	953	985	933	920	843	927
Losses (including extraction)	(1,107)	(1,417)	(1,237)	(1,432)	(980)	(1,185)
Total supply	**19,955**	**19,903**	**18,361**	**16,442**	**18,203**	**17,094**
Exports	73	49	52	55	55	55
Stock change	344	(23)	308	(448)	197	(238)
Domestic demand	**19,538**	**19,877**	**18,001**	**16,835**	**17,951**	**17,277**
	Sector demand (Trillion BTU)					
Residential & commercial	7,581	7,539	7,434	7,025	7,292	7,049
Industrial	8,532	8,394	7,117	6,823	7,448	7,088
Transportation	595	648	613	505	546	524
Electric utility	3,240	3,810	3,343	2,999	3,221	3,152
Total	**19,948**	**20,391**	**18,507**	**17,352**	**18,507**	**17,813**

Source: Energy Information Administration

NATURAL GAS PROCESSING AND LIQUIDS PRODUCTION

	Billion cu ft			Natural gas liquids	
	Gross gas production	Gas processed	Percent processed	Gallons per Mcf of gas processed	Liquids produced (000 b/d)
1970	23,786	18,509	77.8	1.376	1,661
1971	24,088	19,252	79.9	1.348	1,693
1972	24,016	19,906	82.9	1.347	1,744
1973	24,067	19,679	81.8	1.353	1,737
1974	22,849	18,684	81.8	1.386	1,689
1975	21,103	17,748	84.1	1.410	1,632
1976	20,944	17,718	84.6	1.388	1,604
1977	21,097	17,570	83.2	1.400	1,618
1978	21,308	17,012	79.8	1.381	1,567
1979	21,883	16,400	75.0	1.481	1,585
1980	21,870	15,750	72.0	1.537	1,576
1981	21,597	14,817	68.6	1.664	1,609
1982	20,210	14,164	70.1	1.678	1,550
1983	18,597	13,173	70.8	1.814	1,559
1984	20,192	13,946	69.1	1.792	1,630
1985E	19,111	13,378	70.0	1.859	1,622

Source: IPAA



Source: Energy Information Administration

U.S. GAS PRODUCTION AND RESERVES

	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	% change 85/73
	(Billion cu ft)													
Marketed production:														
Texas	8,514	8,171	7,486	7,192	7,051	6,548	7,175	7,116	6,910	6,469	5,939	6,185	6,012	−29.4
Louisiana	8,242	7,754	7,090	7,007	7,215	7,476	7,266	6,940	6,780	6,172	5,332	5,825	5,145	−37.6
Others	5,891	5,676	5,532	5,754	5,759	5,950	6,030	6,124	6,266	5,879	5,551	6,220	6,060	2.9
Total U.S.	**22,648**	**21,601**	**20,109**	**19,952**	**20,025**	**19,974**	**20,471**	**20,180**	**19,956**	**18,520**	**16,822**	**18,230**	**17,218**	**−24.0**
	(Billion cu ft)													
Reserves:														
Total U.S.	249,950	237,132	228,200	216,026	208,878	200,302	194,917	199,021	201,730	201,512	200,247	197,463	197,000	−21.2
	(Years)													
Reserves/production ratio:														
Total U.S.	11.04	10.98	11.35	10.83	10.43	10.03	9.52	9.86	10.11	10.88	11.90	10.83	11.44	

Source: American Petroleum Institute; Energy Information Administration

The price of natural gas increased at an annual rate of 30.8% from 1973 to 1982.

natural gas went up 1,118.2% from $0.22/mcf in 1973 to $2.46/mcf in 1982. That is an average annual increase of 30.8%.

Even in the face of falling demand throughout 1981 and 1982, prices continued to move up relentlessly. Long-term contracts entered into when the accepted outlook was for a natural gas shortage, continued to push up prices.

Because of the take-or-pay provisions in most contracts, it became advantageous for the pipelines purchasing gas to continue to take high-priced gas and curtail acceptance of the lower-priced gas when demand began to fall. This aggravated the situation and drove up the cost. This cost was passed on to consumers.

Price increases were somewhat more moderate during 1983 and 1984. The average wellhead price moved up 5.3% in 1983 to $2.59/mcf, and up a modest 2.7% in 1984 to $2.66/mcf. From 1973 through 1984, the price increase was $2.44/mcf.

Over the same period, the price paid by electric plants increased $3.37/mcf from $0.35/mcf in 1973 to $3.72/mcf in 1984. The residential price moved up $4.77/mcf from $1.29/mcf in 1973 to $6.06/mcf in 1984.

Rising gas prices resulted in a sharp drop in consumption.

The price paid by electic utilities moved up 963%, and the residential price moved up 369.8% over the 1973–1984 period. This led to a great deal of conservation and fuel switching. Faced with that rate of increase in natural gas energy costs, an effort was made by all consumers to conserve.

Consumption of natural gas fell from 22.05 trillion cu ft in 1973 to 16.84 trillion cu ft in 1983, a drop of 23.6%. It rebounded to 17.95 trillion cu ft in 1984, an increase of 6.6% from the previous year. It dropped slightly to 17.32 trillion cu ft in 1985.

Natural gas has held a cost advantage over heating oil in the residential market, and a cost advantage over residual fuel oil in the utility and industrial sectors. By 1982 a substantial portion of this cost advantage had eroded and natural gas was meeting competition it had not experienced before. In the residential sector, conversions from home heating oil to natural gas slowed. And in the industrial and utilities sectors, natural gas fell victim to the recession and to completion from other fuels. This was also due to the fuel use regulations, which gave industry and utilities low priority in the case of a curtailment of supply. Without assurances of a reliable source of gas, industry had sought other fuels.

The combination of increased exploration and declining consumption resulted in a deliverability surplus for natural gas.

In fact, industry has been moving toward installing multiple fuel capabilities so they can take advantage of any price differentials between fuels. This may also become prevalent for residential and commercial heating in future years. The overall result of the natural gas market distortions has been the present gas surplus with deliverability far in excess of demand.

A great deal of concern was expressed over a possible "fly-up" in prices when partial decontrol occurred as of the first of 1985. But again the influence of market forces was far stronger than presumed by regulators. With substantial competitive pressure from other fuels, natural gas prices fell during 1985.

The average wellhead price in 1985 was $2.48/mcf, down 6.8% and the price paid by electric plants slipped 3.8% to $3.58/mcf.

Natural gas consumption slipped 3.5% in 1985 to 17.32 trillion cu ft, even though prices were down.

Marketed production of natural gas in the U.S. followed demand, falling from 22,648 billion cu ft in 1973 to 16,822 billion cu ft in 1983, down 25.7%. Production moved up in 1984 to 18,230 billion cu ft, an

MARKETED PRODUCTION OF NATURAL GAS BY STATES*

State	1979	1980	1981	1982	1983	1984	1985
	(Billion cu ft)						
Alabama	85.8	65.3	79.2	75.0	90.8	101.8	106.6
Alaska	220.8	230.6	242.6	264.4	276.7	289.1	323.8
Arkansas	109.5	111.8	93.0	124.6	127.6	135.2	128.7
California	248.2	309.4	380.4	384.0	415.3	476.3	494.0
Colorado	191.2	188.0	195.7	209.9	163.5	173.3	187.1
Florida	50.2	40.6	32.5	22.5	21.1	12.6	10.6
Kansas	797.8	735.0	640.1	429.6	434.7	466.0	513.0
Louisiana	7,266.2	6,939.9	6,780.2	6,171.6	5,332.1	5,825.1	5,146.3
Michigan	159.7	158.3	152.6	153.1	138.9	144.5	148.4
Mississippi	144.1	175.1	181.2	167.2	151.2	157.9	132.5
Montana	53.9	51.9	56.[illegible]	56.5	52.0	51.5	53.3
New Mexico	1,181.4	1,148.1	1,132.1	991.2	895.3	957.4	896.3
North Dakota	18.5	42.3	42.6	53.8	69.3	70.5	78.3
Oklahoma	1,835.4	1,891.8	2,019.2	1,934.4	1,730.1	1,985.9	1,787.7
Texas	7,174.6	7,115.9	6,910.0	6,468.8	5,938.6	6,185.0	6,011.8
Utah	53.6	87.8	91.2	94.3	63.2	74.7	68.5
W. Virginia	150.5	156.6	161.3	150.9	130.1	143.7	136.9
Wyoming	414.4	407.1	408.4	424.7	444.0	516.7	497.3
Others	310.7	324.3	357.2	343.4	347.8	462.4	496.7
Total	20,471.3	20,179.7	19,955.8	18,519.7	16,822.1	18,229.6	17,217.8
Volume change	497	−292	−224	−1,436	−1,698	1,407	1,012
Percent change	2.5	−1.4	−1.1	−7.2	−9.2	8.4	−5.6

*Includes nonhydrocarbon gases.

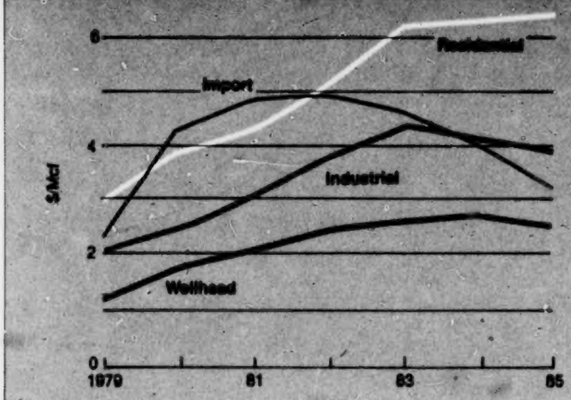
Source: Energy Information Administration

PRODUCTION, IMPORTS

	Total marketed prod.	Imports	Total new supply*	Imports % total supply
	(Billion cu ft)			
1973	22,648	1,033	23,681	4.4
1974	21,601	959	22,560	4.3
1975	20,109	953	21,062	4.5
1976	19,952	964	20,916	4.6
1977	20,025	1,011	21,036	4.8
1978	19,974	966	20,940	4.6
1979	20,471	1,253	21,724	5.8
1980	20,180	985	21,165	4.7
1981	19,956	904	20,860	4.3
1982	18,520	933	19,453	4.8
1983	16,822	920	17,742	5.2
1984	18,230	843	19,073	4.4
1985	17,218	927	18,145	5.1

*Before losses.

Source: Energy Information Administration



Source: Energy Information Administration

NATURAL GAS PRICES

	1979	1980	1981	1982	1983	1984	1985
	$/1,000 cu ft						
Wellhead price	1.18	1.59	1.98	2.46	2.59	2.66	2.40
Import price	2.49	4.42	4.84	4.94	4.51	4.08	3.16
Industrial sales price	2.01	2.50	3.11	3.73	4.28	4.13	3.91
Residential price	2.98	3.68	4.29	5.17	6.06	6.12	6.13

increase of 8.4%. However, production fell again in 1985, down 5.5% to 17,230 billion cu ft.

There has been some concern expressed about the impact of natural gas imports on domestic production. However, there does not appear to be any upward trend in gas imports. From 1973 through 1985, imports ranged from 904 billion cu ft to 1,253 billion cu ft. As a percentage of total supply they range from 4.1% in 1974 and 1981 to 5.5% in 1979. The average was 4.5% of total supply. Imports were up in 1985 at 950 billion cu ft, 4.8% of total supply.

Import prices in recent years have been higher than domestic prices, and therefore there was no great incentive to increase import volumes. However, Canada has recently adjusted price to be more competitive in the U.S. market, and is taking steps to promote increased exports to the U.S.

Natural gas well drilling increased substantially with rising prices.

The higher gas prices stimulated the supply side for natural gas. Exploration and production activity moved up sharply during the drilling boom year 1979–1982. This led to an increase in natural gas deliverability as demand was falling, and created the gas bubble.

The number of gas wells completed moved up from 3,983 in 1971 to 19,742 in 1981 and 18,363 in 1982. And the number of completions has remained relatively high over the 1983–1985 period. Gas well completions dropped to 14,619 in 1983, but then moved up to 17,201 in 1984 and 16,390 in 1985.

Natural gas reseves fell sharply from 249,950 billion cu ft in 1973 to 194,917 billion cu ft in 1979, down 22%. The reserves-production rate fell from 11.04 years in 1973 to 9.52 years in 1979.

However, with the increased exploration and drilling activity, reserves have been sustained and actually increased slightly since 1979. Reserves at year-end 1985 were estimated at 197,000 billion cu ft. And the reserves-production ratio has moved up to 11.44 years.

Gas production has not fallen at the same pace as gas production. Marketed production of natural gas in 1985 was down 23.9% from 1973. However, NGL production in 1985 was 1.609 million b/d, down only 7.4% from 1973.

The quantity of gas processed has fallen 32%, but the extraction rate has improved substantially. Natural gas liquids recovered per mcf has increased from 1.353 gallons in 1973 to an estimated 1.850 gallons in 1985. This is an increase of 37.4% in the liquid extraction level. The level of extraction is tied to the relative value of the liquids versus the value of the natural gas with a higher liquids content.

Outlook

Natural gas is expected to face a great deal of competition from competing fuels over the forecast period. The sharp drop in crude oil prices has substantially increased the competition from distillate and residual fuel oil. Coal already has a price advantage in many areas and is expected to sustain it during the forecast period.

Consumption and production of natural gas will slip marginally over the forecast period.

It is not expected that the natural gas market will be able to react fast enough in response to the increased competition. Therefore, even though economic activity will be increased over the 1986–1991 period, natural gas consumption will slide. Demand is forecast at 16,585 billion cubic feet in 1991, down 1.8%.

The natural gas industry is beginning to become more aggressive in marketing, and this will help it to sustain existing markets. But prices are presently high, relative to competing fuels, and this will prevent gas from capturing new markets.

There is presently a lot of downward pressure on prices. But the structure of the industry with substantial price regulation makes it less responsive to market changes. Prices are expected to stabilize in 1986 and 1987 at $1.95/mcf. Prices are expected to increases gradually over the remainder of the forecast period as other energy costs rise and as the deliverability surplus is diminished. But the increase in price will be less than for crude oil, and this will prevent a further deterioration of the natural gas markets. Prices will move up 15.4% to $2.25/mcf in 1991.

If prices do drop further than anticipated, natural gas may be able to exhibit some growth along with growth in the economy.

Imports are not expected to increase over the forecast period. Total imports are forecast to remain around 900 billion cubic feet per year throughout the 1986–1991 period. With a deliverability surplus and generally lower prices, additional imports are not expected to arrive in the U.S. market.

The deliverability surplus should slowly erode over the forecast period. Exploration and drilling activity have fallen sharply, and some production is being shut in due to the lower prices. This will reduce deliverability, and even with declining demand, the gap will close.

There is a lot of future potential for the U.S. natural gas industry. But rigidities in the industry, partly due to government regulations, will prevent natural gas from reaching its full potential over the forecast period.

THE OUTLOOK — NATURAL GAS

	1986	1987	1988	1989	1990	1991	Change 1986 to 1991	% change 1986 to 1991
NATURAL GAS (billion cubic feet)								
Marketed production	16,925	16,910	16,865	16,630	16,625	16,620	–305	–1.8
Imports	910	910	910	905	900	900	–10	–1.1
Demand	16,890	16,875	16,830	16,595	16,590	16,585	–305	–1.8
SECTOR DEMAND (billion cubic feet)								
Residential	4,380	4,375	4,370	4,350	4,340	4,330	–50	–1.1
Commercial	2,380	2,380	2,370	2,355	2,360	2,370	–10	–0.4
Industrial	5,880	5,900	5,910	5,790	5,820	5,845	–35	–0.6
Electric utilities	2,740	2,730	2,720	2,680	2,670	2,660	–80	–2.9
Pipeline & plant fuel	1,510	1,490	1,460	1,420	1,400	1,380	–130	–8.6
Total demand	**16,890**	**16,875**	**16,830**	**16,595**	**16,590**	**16,585**	**–305**	**–1.8**
PRICE:								
U.S. wellhead price ($ per thousand cubic feet)	1.95	1.95	2.00	2.05	2.15	2.25	+0.30	+15.4

OTHER ENERGY

OTHER ENERGY

THE RELATIONSHIP between economic growth and energy growth has changed markedly since the price of oil and other energy increased rapidly in the 1970s. Energy is still required to fuel ongoing and increasing economic activity. However, the amount of energy required for every dollar of GNP has been decreasing since 1970.

What has also been evident has been the shift in the relative share of energy coming from the major sources. Since the cost of oil and natural gas moved up much faster than the cost of other energy, the other types of energy gained market share.

Oil and natural gas provide a majority of the energy required, but they do not satisfy the entire need. Petroleum, in fact, is to a major extent the "swing" fuel, satisfying energy needs not met by other fuels. This is particularly true with respect to energy for electrical generation and for heavy industry. Those sectors of the economy look to petroleum only when there is insufficient energy available from cheaper fuel sources, such as coal, hydroelectric and nuclear. This has been particularly true since the 1970s after the price of petroleum skyrocketed.

Petroleum does have its secure niche as a liquid fuel for transportation, a role that does not appear to be threatened. In fact, most long-range forecasts do not see any major economic alternative for petroleum as a transport fuel. But even in this section some alternatives have been introduced. Automobiles and small trucks have been converted to use propane, and there is continuous experimentation with electric cars for short-range city transport.

Recently, as the cost of oil has fallen and the cost of other fuels has continued to increase, the competitive picture has changed. Both petroleum products and natural gas are becoming more price competitive. This has boosted demand for petroleum products and natural gas, and it has also slowed the conservation effort that promoted investment in conversion to other cheaper fuels.

The lower cost of petroleum and natural gas considerably changes the financial economics of investing in capital equipment for conversion to other fuels. It lengthens the pay-back period on the increased capital investment. In many cases conversion has become uneconomical.

Review

Higher energy costs slowed energy consumption.

Price and the shift in the form of economic activity have been two of the major reasons for the move to other energy sources and lower consumption of energy. Petroleum prices and, natural gas prices moved up very sharply over the period 1973–1983. This made it economically attractive to switch to other energy forms, even if it required a substantial investment.

The costs of other energy also increased during this period, although not as rapidly. This made all energy more costly and encouraged not only fuel switching, but energy conservation in general. Finally, the economy is shifting to a more service and information-oriented economy that requires less intensive energy consumption. Total energy consumption peaked in 1979 at 78,898 trillion BTU. It fell to 70,495 trillion BTU in 1983, a drop in total energy use of 10.7%. Energy consumption then moved up to 74,108 trillion BTU in 1984 and was 73,867 trillion BTU in 1985.

From the peak in energy demand in 1979 through 1985, there has been a shift in market share for the major energy sources. Petroleum's share fell from 47.1% to 41.9%. The share from natural gas fell from 26.2% to 24.1%. Coal moved up from 19.1% to 23.7%. Hydroelectric and geothermal moved up from 4.1% to 4.7%, and nuclear power increased from 3.5% to 5.6% of the energy market.

One of the most consistent and long lasting trends has been the growth in the consumption of electrical energy. In 1985, 35.6% of the total energy consumed was energy input for the electric utility industry. The percentage of energy for electrical generation has steadily been increasing, moving up from 26.6% in 1973. This upward trend, to a higher percentage of energy for electrical generation, will

ELECTRICITY GENERATION AND FUEL CONSUMPTION

	Total electricity generated (Billion kwh)	Fuels consumed Coal (1,000 st)	% of total	Petroleum (1,000 bbl)	% of total	Natural gas (bcf)	% of total	Nuclear, hydro & other % of total
1973	1,860.7	389,212	45.6	560,248	16.9	3,660.2	18.3	19.2
1974	1,867.1	391,811	44.4	536,274	16.1	3,443.4	17.1	22.4
1975	1,917.6	405,962	44.5	506,128	15.1	3,157.7	15.6	24.8
1976	2,037.7	448,371	46.4	555,920	15.7	3,080.9	14.4	23.5
1977	2,124.3	477,126	46.4	623,705	16.9	3,191.2	14.4	22.3
1978	2,206.3	481,235	44.2	635,839	16.6	3,188.4	13.8	25.4
1979	2,247.4	527,051	47.8	523,297	13.5	3,490.5	14.7	24.0
1980	2,286.4	569,274	50.8	420,214	10.8	3,681.6	15.1	23.3
1981	2,294.8	596,797	52.4	351,111	9.0	3,640.2	15.1	23.5
1982	2,241.2	593,666	53.2	249,771	6.6	3,225.5	13.6	26.6
1983	2,310.3	625,211	54.5	245,497	6.3	2,910.8	11.9	27.3
1984	2,416.3	664,399	55.5	204,479	5.0	3,111.3	12.3	27.2
1985	2,469.8	693,841	56.8	173,414	4.1	3,044.1	11.8	27.3

Source: Energy Information Administration

ELECTRIC SECTOR: RELATION TO TOTAL PRODUCT DEMAND

	Total coal consumption — (1,000 short tons)	Coal consumed in electric generation — (1,000 short tons)	%	Total petroleum consumption (1,000 b/d)	Petroleum consumed in electric generation (1,000 b/d)	%	Total natural gas consumption (bcf)	Natural gas consumed in electric generation (bcf)	%
1973	562,584	389,212	69.2	17,308	1,535	8.9	22,049	3,660.2	16.6
1979	680,524	527,051	77.4	18,513	1,433	7.7	20,241	3,490.5	17.2
1985	817,993	693,841	84.8	15,697	475	3.0	17,277	3,044.1	17.6

Source: Energy Information Administration

COAL PRODUCTION

	Production	Consumption (1,000 short tons)	Imports	Exports
1973	598,568	562,584	127	53,587
1974	610,023	558,402	2,080	60,661
1975	654,641	562,641	940	66,309
1976	684,913	603,790	1,203	60,021
1977	697,205	625,291	1,647	54,312
1978	670,164	625,225	2,953	40,714
1979	781,134	680,524	2,059	66,042
1980	829,700	702,729	1,194	91,742
1981	823,775	732,627	1,043	112,541
1982	838,112	706,911	742	106,277
1983	782,091	736,672	1,271	77,772
1984	895,921	791,296	1,286	81,483
1985	886,096	817,993	1,952	92,680
% chg. 85/73	+48.0	+45.4	+1,437.0	+73.0

Source: Energy Information Administration

Demand for electrical energy is expected to continue to increase as the economy shifts to services and automation.

continue for the foreseeable future. The economy is shifting to more service and information-oriented activity and industry is shifting toward more automation. Both of these movements call for energy in the form of electricity.

Providing adequate electrical power to meet this growing demand may become a serious issue in the 1990s. The two major sources of energy for electrical power generation are coal and nuclear power. Both of these sources are under attack from groups concerned about nuclear power dangers and potential pollution.

Coal has been, and continues to be, the primary fuel source for electrical utilities. Coal has moved up from 43.6% of the fuel used in 1973 to 55.0% in 1985. Over the same period, nuclear fuel increased its share from 4.6% to 15.7%.

Moving down, petroleum went from 17.7% of the fuel consumed for electrical power generation in 1973, to 4.1% in 1985. The amount of petroleum consumed for electrical power generation fell 69%.

The natural gas share of energy consumed for electrical generation fell from 18.9% in 1973 to 11.9% in 1985. The amount of gas consumed for power generation fell 16.8% over the same period.

Hydroelectric, geothermal and other power accounted for 15.2% of total energy in 1973 and was 13.2% in 1984.

The share of total petroleum demand consumed by electrical utilities has fallen from 8.9% in 1973 to 3.6% in 1984. The amount consumed for electrical output dropped from 1.535 million b/d in 1973 to 475,000 b/d in 1985, a decline of 69%.

The volume of natural gas consumed by electrical utilities dropped 16.8% between 1973 and 1985, but consumption has not fallen steadily. Electrical utility consumption fell 20.9% from 1980 to 1983, rebounded in 1984, increasing 6.9%, and then fell 2.2% in 1985. In 1985, electric utilities consumed 3,044 billion cubic feet, 17.6% of total consumption.

Coal and nuclear power displaced consumption of petroleum utilities and heavy industry.

Total coal consumption has risen steadily since 1973. Coal demand was 562.6 million short tons in 1973 and increased to 818 million short tons in 1985, up 45.4%. Coal consumption varies with economic activity, but increased consumption by electric utilities continues to push up demand. Coal consumed by electric utilities has increased 783%, from 389.2 million short tons in 1973 to 693.8 million short tons in 1985. The percentage of total coal consumed in electric generation increased from 69.2% in 1973 to 84.8% in 1985. Over this period, coal consumed by utilities moved up 305 million short tons. Total coal consumption moved up only 255 million short tons. Obviously, the long-run growth in coal consumption is depenedent upon the growth in electrical generation.

Nuclear power's contribution to electrical production has also been moving up steadily. The number of operable nuclear reactors increased from 39 at year-end 1973 to 95 at year-end 1985. Electricity generated increased from 83.5 million kilowatthours at 1973 to 383.7 million kilowatthours in 1985, a 359.6% increase. The capacity, defined as "net summer capacity of operable reactors", moved up from 22,615 million net kilowatts in 1973 to 79,509 million net kilowatts in 1985, up 251.6%. The percentage of capacity utilized has fluctuated substantially. It has varied from 47.9% in 1974 to 64.7% in 1978. After the Three Mile Island incident, the utilization rate fell. Concerns for safety increased the down time for maintenance and safety checks.

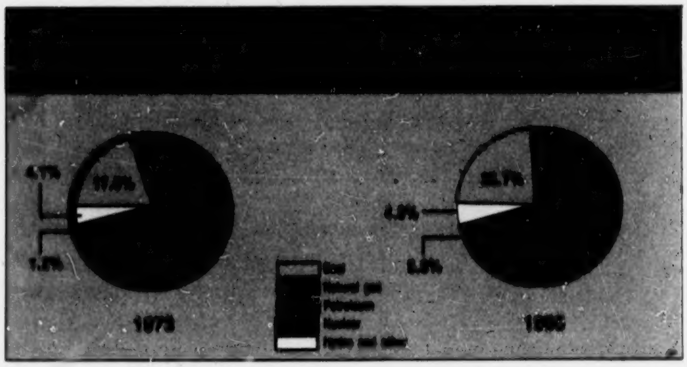
The rate fell to 54.4% in 1983, but improved in 1984, moving up to 56.3%, and 57.9% in 1985.

Outlook

Total energy consumption will move up over the forecast period along with the increase in economic activity. Energy demand in 1991 will be up 7.7% above 1986 at 80.29 quads.

The increase in energy consumption will be led by an increase in electrical power consumption and output. The shift toward a more service-oriented and automated economy will increase demand for electrical power. Electric power consumption will increase faster than demand for energy. Coal and nuclear energy will continue to increase their market shares of fuel for electric power generation and therefore their share of total energy. This shift will accelerate as the economy

Lower energy costs will boost consumption over the forecast period.



NUCLEAR POWER PLANT OPERATIONS

	Number of reactors	Electricity generated (Million net kwh)	% of total electricity generated	Net summer capability (Million net kw)	Capacity utilized (%)
1973	39	83,479	4.5	22.615	53.7
1974	48	113,976	6.1	31.803	47.9
1975	54	172,505	9.0	37.161	56.0
1976	61	191,104	9.4	43.657	54.9
1977	65	250,883	11.8	46.202	63.4
1978	70	276,403	12.5	50.709	64.7
1979	68	255,155	11.4	49.630	58.5
1980	70	251,116	11.0	51.668	56.4
1981	74	272,674	11.9	55.914	58.4
1982	77	282,773	12.6	59.927	56.7
1983	80	293,677	12.7	63.009	54.4
1984	86	327,634	13.6	69.652	56.3
1985	95	383,691	15.5	79.509	57.9
% chg 85/73	+143.6	+459.6	—	+251.6	—

Source: Energy Information Administration

ELECTRICITY SALES

	Residential	Commercial	Industrial (Million kwh)	Other	Total
1973	579,231	388,266	686,085	59,328	1,712,910
1974	578,184	384,826	684,875	58,039	1,705,924
1975	588,140	403,049	687,680	68,222	1,747,091
1976	606,452	425,094	754,069	69,631	1,855,246
1977	645,239	446,514	786,037	70,571	1,948,361
1978	674,466	461,163	809,078	73,215	2,017,922
1979	682,819	473,307	841,903	73,070	2,071,099
1980	717,495	488,156	815,067	73,732	2,094,449
1981	722,265	514,338	825,742	84,756	2,147,101
1982	729,519	526,397	744,949	85,575	2,086,440
1983	750,948	543,788	775,999	80,219	2,150,955
1984	777,654	578,281	840,588	81,849	2,278,372
1985	790,978	608,968	824,495	85,774	2,310,215
% chg 85/73	+36.6	+56.8	+20.2	+44.6	+34.9

Source: Energy Information Administration

expands more rapidly at the end of the 1980s. Electric power generation will increase 32.1% between 1986 and 1991.

Since there is a trend to increase demand for electrical power, demand for coal should continue to move up through 1991. From 1986 to 1991, as the economy continues to expand, electric power demand will move up. Coal consumption will follow upward as the primary source of energy for electrical generation. Total coal consumption will move up 9.1% to 900 million short tons. Electric utility consumption will move up about 17% to 812 million short tons.

With lower prices for crude oil and natural gas, the increase in coal consumption by utilities could be slowed. In addition, the long-term outlook for coal may be clouded by environmental considerations, particularly the acid rain issue.

However, over the forecast period, the cost advantage of coal is expected to prevail and all energy from coal is expected to increase 9.3%. Coal's share of the market will move up from 23.5% in 1986 to 24% in 1991.

Nuclear will continue to increase, but its long-range growth is becoming dependent upon political conditions rather than economic ones. However, both capacity and the utilitization rate are expected to move up throughout the forecast period. Electrical power generation from nuclear power is expected to increase 33.3% as new plants come on stream and the capacity utilization rate improves.

Lower prices will boost demand for petroleum energy.

Because of the political debate over the safety of nuclear power, the long-term growth of nuclear power is uncertain. However, increased capacity from newly-commissioned plants and increased output from existing plants should boost nuclear energy output over the 1986 to 1991 period. New facilities will be commissioned cautiously, slowing the rate of growth. With lead times of ten years on construction of new reactors, it does not appear that substantial long-range growth can be expected beyond 1991.

If the problems associated with nuclear power and coal consumption restrict their expansion, demand for natural gas and petroleum for electrical power output could well increase in the future.

Hydropower and geothermal capacity is not expected to increase much over the forecast period. Hydropower will continue to provide energy to the full extent available, but is dependent upon existing weather conditions.

THE OUTLOOK — OTHER ENERGY

	1986	1987	1988	1989	1990	1991	Change 1986 to 1991	% change 1986 to 1991
ENERGY DEMAND (trillion BTU)								
Petroleum	31,780	32,420	32,820	33,165	33,565	33,960	+2,180	+ 6.9
Natural gas	17,410	17,400	17,355	17,110	17,105	17,100	− 310	− 1.8
Coal	17,610	17,945	18,235	18,565	18,890	19,240	+1,630	+ 9.3
Nuclear	4,480	4,875	5,175	5,485	5,760	6,000	+1,520	+33.9
Hydro and other	3,770	3,835	3,885	3,920	3,940	3,990	+ 220	+ 5.8
Total energy demand	**75,050**	**76,475**	**77,470**	**78,245**	**79,260**	**80,290**	**+5,240**	**+ 7.0**
Coal consumption (million short tons)	825	840	855	870	885	900	+ 75	+ 9.1
Electricity generation (billion kilowatthours)	2,545	2,620	2,695	2,770	2,855	2,940	+ 395	+15.5
Nuclear capacity (million kilowatts)	81	89	96	101	105	107	+ 26	+32.1
Nuclear generation (billion kilowatthours)	420	455	480	510	535	560	+ 140	+33.3

PRICES AND PRICING

PRICES AND PRICING

THE PREOCCUPATION with the price of crude oil and petroleum products is a development that resulted when the OPEC countries took control of the majority of worldwide export crude. They started pushing up the price of crude oil in 1971, and by 1973 price was a major concern for the oil industry.

Prior to that, 1950–1970, the price of crude oil was an afterthought for oil industry planners and analysts. The major concerns were estimating the level of demand and planning crude production and refining capacities to meet this demand.

The development of new production in the OPEC countries provided a more than adequate supply and the price remained low with little, if any, change. In fact, posted prices generally came down slightly over this period. Posted prices for the major export crudes varied from $1.67/bbl to $2.42/bbl over this period, with the major differences being due to crude gravity and quality, and location. Lighter-weight crudes generally command a slightly higher price. Crudes in a location closer to the refining market reduce transport costs and therefore can get a higher price.

The average wellhead price of U.S. crude oil did move up over this twenty-year period, but the increase was less than the inflation rate. The price went up only 26.7% from $2.51/bbl in 1950 to $3.18/bbl in 1970. But with the rate of inflation increasing more rapidly than crude oil prices, the real price declined, falling 25.6% over this period.

With nominal prices low and real prices falling, little attention was given to the cost of energy. But when OPEC forced the price up over 350% in 1973–1974, and up another 170% in 1979–1981, it caught everyone's attention. Conservation became the rage and demand for petroleum products started moving down after over forty years of continuous growth. The price has been one of the major concerns ever since.

Based on the average U.S. wellhead price, the real price of crude oil had dropped to $7.80/bbl in 1985. This was the lowest price since 1979. At an actual transaction price of $10/bbl, the deflated real price would be $3.16/bbl in 1986. This would be the lowest price since 1973, when OPEC first started rapidly raising prices. It would be a price comparable to the U.S. wellhead price in 1954.

Futures Market

When OPEC gained control of production, industry integration was fractured. A substantial share of the world-traded crude was no longer controlled by companies with refining facilities and market outlets. The producing countries had adopted aggressive pricing practices that added substantial uncertainty to crude oil trading.

Price volatility and increased spot market transactions led to the development of a petroleum futures market.

When demand for crude started falling and a large excess capacity developed, trading in the spot market became more prominent. Producers were trying to sell additional volumes of crude that could not be sold at the high official posted prices and crude purchasers were looking for lower-cost crude to supply their refineries. Trading on the spot market expanded rapidly. By 1985 the vast majority of crude

AVERAGE ANNUAL PRICE OF CRUDE OIL

	U.S. average wellhead price		Saudi Arabian light crude	
Year	Current dollars	Constant 1967 dollars	Current dollars	Constant 1967 dollars
1950	2.51	3.07	—	—
1951	2.53	2.78	1.75	1.92
1952	2.53	2.86	1.75	1.98
1953	2.68	3.07	1.97	2.25
1954	2.78	3.17	1.97	2.25
1955	2.77	3.15	1.97	2.24
1956	2.79	3.08	1.97	2.17
1957	3.09	3.31	2.08	2.23
1958	3.01	3.18	2.08	2.20
1959	2.90	3.06	1.90	2.00
1960	2.88	3.03	1.80	1.90
1961	2.89	3.06	1.80	1.90
1962	2.90	3.06	1.80	1.90
1963	2.89	3.06	1.80	1.90
1964	2.88	3.04	1.80	1.90
1965	2.86	2.96	1.80	1.86
1966	2.88	2.89	1.80	1.80
1967	2.92	2.92	1.80	1.80
1968	2.94	2.87	1.80	1.76
1969	3.09	2.90	1.80	1.69
1970	3.18	2.88	1.80	1.63
1971	3.39	2.98	2.29	2.01
1972	3.39	2.85	2.48	2.08
1973	3.89	2.89	5.04	3.74
1974	6.74	4.21	11.25	7.03
1975	7.56	4.32	12.38	7.08
1976	8.14	4.45	11.51	6.29
1977	8.57	4.41	12.70	6.54
1978	8.96	4.28	12.70	6.07
1979	12.51	5.31	24.00	10.19
1980	21.59	8.03	32.00	11.91
1981	31.77	10.83	34.00	11.59
1982	28.52	9.53	34.00	11.36
1983	26.19	8.64	29.00	9.57
1984	25.88	8.34	29.00	9.35
1985	24.08	7.80	28.00	9.07
1986E	13.50	4.27	14.00	4.42

was either traded on the spot market or prices were based on spot market transactions.

The greater level of uncertainty has made crude and product trading more like all commodities.

With a growing level of competition and uncertainty, trading petroleum products and crude oil became like other commodities. The increase in the amount of risk encouraged the development of strategies for hedging to reduce risk. This resulted in the development and growth of a futures market.

Too much uncertainty and risk can stifle action and decision making because with a great deal of risk, mistakes can be cost prohibitive. In this way the futures market provides a service by providing a way of reducing risk in the industry.

Futures trading is done through a central exchange using contracts with all terms except the price established by the exchange. The futures contract is a legal committment to deliver or accept delivery of a specified commodity at a designated time and location in the future. It is a committment to buy or sell in the future and ownership does not change hands.

There are three major types of futures transactions. The first is hedging. This is a method for trying to eliminate risk by taking opposing positions simultaneously in the futures market and the physical transactions market. This provides some price certainty over a period of time because unexpected losses in the physical market can be made up by gains in the futures market, or vice versa. There is a slight premium or cost associated with using this process for reducing risk, but removing the risk enables decisions to be made without fear of a total financial disaster.

Another type of transaction that can occur in the futures market is

NEW YORK MERCANTILE EXCHANGE

Total annual contract volumes
Thousand contracts
(Million barrels)

Year	Total oils	Crude oil	Heating oil	Leaded gasoline	Unleaded gasoline
1978	50	—	50	—	—
1979	100	—	100	—	—
1980	240	—	240	—	—
1981	1,010	—	950	60	—
1982	1,850	—	1,725	125	—
1983	2,625	350	1,850	425	—
1984	4,589	1,840	2,092	654	3
1985	6,989	3,981	2,208	667	133

Trading vs. deliveries
Crude oil
1984 & 1985
(Thousand barrels)

	Total deliveries	Trading volume	Deliveries as % of trading volume
1984	66,780	1,494,976	4.5
1985	157,991	3,581,102	4.4

NET BACK PRICING EXAMPLE

	$/barrel
Product revenues	18.50
Less: refining costs	2.50
Less: processing/handling fee	2.00
Less: transport cost	1.50
Net back price of crude*	**12.50**

*The net back value varies depending on product revenues and costs

NYMEX futures market petroleum contract volumes reached close to 7 billion barrels in 1985.

the actual physical trading of crude oil or products. These types of market trades account for less than 1% of total trading volume in crude oil futures according to the New York Mercantile Exchange (NYMEX). A delivery mechanism exists for the exchange so that futures and actual spot prices converge in the current month.

The futures market is not flexible enough to be used for all daily business transactions. The limited number of products and precise quantity and quality requirements limit the flexibility.

The third type of transaction is speculation. These are transactions by investors who are trading futures contracts for the sole purpose of making profits on price changes. The participation of speculators is necessary because they assume the risk that hedgers are trying to avoid.

There is a multitude of complex combinations of trading that are used in the futures market, but they are all basically trades for the purpose of hedging or speculating.

The futures market has grown rapidly in the existing climate of uncertainty. Futures market trading for petroleum industry commodities started on the NYMEX in 1978 with home heating oil. Leaded gasoline was added in 1981 and crude oil in 1983. The total annual contract volume went from 50,000 (50 million barrels) in 1978 to 6,989,000 (6,989 million barrels) in 1985.

The futures market provides traders with a very transparent daily indicator of the present thinking with respect to future product and crude oil prices. It is one of the most useful tools available for determining the basis for price negotiations. Therefore, the futures market does and will continue to play an important role in helping to set prices. As long as uncertainty and risk remain, the futures market will exist, flourish and undoubtedly gain in size.

Netback Pricing

A new form of term contract for trading crude oil became prevalent over the past year. These contracts have varying details but are generally known as netback contracts.

Under netback contracts, the price of the crude traded is based upon the value or selling prices of the refined products. The value of the products that can be obtained from the specific type of crude oil are determined by the sales price during a specified time period. From this value are deducted the costs associated with refining the products and transporting the crude and a specified processing fee or refiner margin. The remainder is the netback value or price of the crude, and represents the amount remitted to the producer.

This type of agreement is advantageous to refiners. It removes the element of risk inherent in rapidly fluctuating product markets and locks in a profit margin. To refiners that have generally experienced low and even negative margins over the last few years, netback contracts are extremely attractive. All of the risk associated with a volatile products market is shifted to the producer.

Netback pricing resulted from the intense competition among crude exporters due to the massive surplus capacity.

These contracts were introduced by exporting countries (initially Saudi Arabia) that wanted to increase their market share. These netback agreements enabled them to markedly expand their sales in a very competitive market situation. Refiners or traders were willing to commit to purchasing large volumes of crude oil because they were assured of a profit with little, if any, risk.

Using the netback pricing vehicle, Saudi Arabia managed to rapidly boost their output from 2.2 million b/d in August 1985 to 4.5 million b/d in December 1985 and an estimated 5.8 million b/d in July 1986. Because of their success, other major exporters have adopted similar contracts. It is now estimated that possibly 75% of the crude oil traded is based upon some form of netback arrangement. A year earlier, 75% was being sold on the spot market.

Netback prices are a product of the very competitive climate in the crude oil market due to the excess capacity. Since the excess capacity will be around for some time, netback contracts can also be expected to be used throughout a good portion of the forecast period.

Netback contracts are longer-term than the prevalent spot market trading of the past few years. This may bring in a little more certainty to the crude oil market, but the volatility will probably only be reduced substantially when the excess capacity situation in refining and marketing has been reduced.

At the present time, there is a great deal of competition in the marketing sector of the business. This situation is somewhat aggravated by the netback arrangements that promote moving large volumes of product without consideration of product price. However, as demand grows and the excess capacity is diminished, some of these competitive pressures will also be alleviated.

OTHER FORECASTS

OTHER FORECASTS

INVESTMENT and operating decisions have to be made based upon the future outlook deemed most likely. But when formulating that outlook it helps to review opinions from other recognized industry analysts or groups.

Several groups have made publicly available their longer-range forecasts for the U.S. and worldwide energy and oil industry. These forecasts were published at different times during the first half of 1986. Therefore, they did not all have the opportunity to observe the full extent of the drop in oil prices that occurred during the first half of 1986.

Following is a brief summary of the highlights from a few of these forecasts.

Chevron

The Economics Department of the Chevron Corporation published its "World Energy Outlook, forecast through the year 2000" in June, 1986.

The Chevron 1986 World Energy Outlook is based upon what they have labeled a "high trend oil price." According to the Chevron report, "This trend assumes reestablishment, by 1987, of prices above the low levels observed in the first quarter of 1986, but below the higher prices that prevailed in the early 1980s."

To further quote the Chevron report, "Thereafter, prices firm moderately throughout the 15-year horizon in response to gradual improvement in economic growth which allows oil demand to increase sufficiently for most producers to reach their capacity within a few years. After the end of the century, prices would continue to rise, reflecting the higher cost of developing less accessible deposits until they are limited by the cost of producing synthetic fuels such as oil from coal or shale."

The oil price is forecast to be in the range of $20-$25 per barrel by 1987, and $28-$35 per barrel by 2000–in 1986 dollars.

Oil prices will move back up to the $20–25/barrel by 1987 according to Chevron.

They forecast real economic growth in the U.S. to be at a rate of 2.5% per year from 1985 through 2000. For the world, economic growth would be 3% per year for the same period.

Chevron projects U.S. energy consumption to grow at a rate of 1% per year from 1985 through 2000, and non-communist world energy consumption to increase 2.1% per year.

Oil consumption is forecast to increase 0.5% per year in the U.S. over this fifteen-year span. It will increase 1%/year for the total non-communist world. The U.S. share of total non-communist oil consumption will fall to 32% in the year 2000 from 34% in 1985. The Western European share will fall to 23% from 25%, and Japan's share will drop to 9% from 10%.

Chevron broke their forecast of crude oil production into two time periods; 1985 to 1990, and 1990 to 2000. Over the earlier time period, 1985 to 1990, total non-communist world production will increase 0.9% per year. U.S. production is projected to decline 2.4% per year, and OPEC production is expected to increase 2.4% per year over this same period.

From 1990 to 2000, total non-communist world production will increase 1.5% per year. U.S. production will continue to fall 2.4% per year. Western European production will decline 3% per year, but OPEC production will increase 3.8% per year. OPEC output will increase to 56% of the non-communist output from 42% in 1985.

Other highlights of the Chevron report are the following: Oil's share of the total non-communist world's energy consumption will dip to 40% in the year 2000 from 46% in 1985. The decrease will be made up by nuclear, which will increase from 6% to 9%, and coal, which will move up from 20% to 22%. Natural gas will maintain 18% of the market.

Natural gas consumption for the non-communist world will increase 2.6% per year from 1985 to 1990 and 2% per year from 1990 to 2000. For the U.S. they expect natural gas consumption to fall 0.1% per year from 1985 to 1990 and then remain constant to 2000.

Non-communist world coal consumption is forecast to increase 3% per year from 1985 to 2000. While nuclear power will increase 6.3% per year from 1985 to 1990, and 3.6% per year from 1990–2000.

In the U.S., nuclear energy will increase 7.8% per year from 1985–1990 and 0.7% per year from 1990–2000.

Ashland

Ashland's Chief Economist presented a long-term energy outlook at an energy conference in April,1986. Following are the highlights from that forecast.

The "Base-Line Scenario" outlook projects the price of Arab Light at $18/bbl in 1987 and on to 1990 in current dollars. In 1985 dollars, the price would fall to $16.55/bbl in 1987, and to $14.58/bbl by 1990. Current dollar and real prices would move up by 1995 to $27.00 and $17.14/bbl.

The economic growth rate for the major industrial countries is projected at 2.3% per year from 1985–1990, and 2.7% per year from 1990–1995. The inflation rate based on the GNP deflator will be 4.3% per year from 1985 to 1990, and 6.0% per year from 1990 to 1995.

Free world energy demand is forecast to increase 1.6% from 1985 to 1990 and 2.2% from 1990–1995. Oil's share of world energy consumption is expected to decline only slightly to 46% in 1990 and remain at this level through 1995. This is down from 47% in 1984.

The natural gas market share is forecast to slip to 17% in 1990 from 18% in 1984, but move back up to 18% by 1995.

The nuclear share of the market is forecast to increase to 7% in 1990 and 8% in 1995, from 4% in 1984. Coal's share of the market is expected to remain at 22% through 1990 and then drop to 20% by 1995.

Free world crude oil demand is forecast to increase 1.4% per year between 1985 and 1990, and increase to 49.0 million b/d. It will move up 2.1%/year from 1990 to 1995, and reach 54.5 million b/d.

U.S. demand for oil is projected to increase to 16.6 million b/d in 1990 and up to 17.5 million b/d in 1995.

Non-OPEC crude and NGL production is projected to slide from 25.4 million b/d in 1985 to 23–25 million b/d in 1990. This will slide further to 20–24 million b/d in 1995. OPEC crude oil production is projected to increase to 19.9–22.4 million b/d in 1990, and then continue up to 26.2-30.7 million b/d in 1995. OPEC's share of total free world supply will increase from 36% in 1985 to 41–46% in 1990, and 48–46% in 1995.

Free world and U.S. oil demand is forecast to increase steadily under Ashland's "Base-Line Scenario."

ASHLAND FORECAST HIGHLIGHTS

	1985	1990	1995
Oil price:			
Current $/bbl	27.50	18.00	27.00
1985 $/bbl	27.50	14.58	17.14

	Annual growth rate 1985-1990	1990-1995
Industrial economies	2.3%	2.7%
Inflation	4.3%	6.0%
Free world energy demand	1.6%	2.2%
Free world oil demand	1.4%	2.1%

	OPEC production 1985	1990	1995
Crude oil (million b/d)	16.1	19.9-22.4	26.2-30.7
Share of total	36%	41%-46%	48%-56%

THE INSTITUTE OF ENERGY ECONOMICS—JAPAN FORECAST HIGHLIGHTS

	$25/bbl	$15/bbl
Annual growth rate: (1985-1995)		
Free world economy	2.7%	3.2%
Energy demand	2.0%	2.6%
Oil demand	1.1%	2.4%
Oil (million b/d):		
Demand-1990	48.2	51.6
Non-OPEC supply 1990	28.2	24.3
OPEC supply 1990	20.0	27.3
Demand 1995	51.0	57.7
Non-OPEC supply 1995	28.2	21.3
OPEC supply 1995	22.8	36.4

CHEVRON FORECAST HIGHLIGHTS

	Annual growth rates (%) 1985-2000	1985-1990	1990-2000
Non-Communst world:			
Economy (total world)	3.0		
Energy	2.1		
Oil demand	1.0		
Oil production		0.9	1.5
OPEC production		2.4	3.8
U.S.:			
Economy	2.5		
Energy	1.0		
Oil demand	0.5		
Oil production		2.4	2.4

	1987	2000
Oil price (1986 $): ($/barrel)	20-25	28-35

	1985	1990
Oil (million b/d):		
Non-Communist demand	45.3	48.0
U.S. production	8.9	7.9
OPEC production	16.2	18.2

EIA FORECAST HIGHLIGHTS

	1985	1990	1995
Oil price:			
Current $/bbl	27	34	50
1985 $/bbl	27	27	30

	Economic annual growth rate 1985-1995	1985-1990	1990-1995
Total market economies	2.9%	2.9%	2.9%
U.S.	2.8%	3.1%	2.5%

	Energy and petroleum 1985	1990	1995
Energy (quad btu)			
Market economies	202.0	225.0	247.4
U.S.	74.8	80.4	84.3
Oil demand (million b/d)			
Market economies	45.6	48.0	49.9
U.S.	15.7	16.1	16.5
Oil production (million b/d)			
Non-OPEC	26.5	26.7	25.2
OPEC	17.0	20.4	24.4
U.S.	11.1	10.4	8.8

Worthy of note is the projection of free world demand for residual fuel oil. Resid demand is expected to increase 0.9%/year from 1985–1990, but then it is projected to increase at an annual rate of 5.3% from 1990–1995.

Energy Information Administration (EIA)

The U.S. Energy Information Administration (EIA) came out in March, 1986 with their "International Energy Outlook 1985, With Projections to 1995." In their base case, EIA projected oil prices in 1985 dollars, to fall to $23/bbl in 1987 and then come back up to $27/bbl in 1990, the same price as 1985. The price used is the U.S. refiner acquisition cost of imported crude oil.

The economic growth rate in the total market economies was forecast at 2.9% per year from 1985–1995. The economic growth rate for the U.S. was forecast at 2.8% per year over this period.

Total energy consumption in the market economies is forecast to increase 11.4% from 202 quadrillion BTU in 1985 to 225 quads in 1990. This is an average annual growth rate of about 2.2%. Energy consumption is projected to increase another 9.96% to 247.4 quads in 1995. This is an average annual rate of 1.9%. Energy consumption in the U.S. is forecast to increase 7.5% to 80.4 quads by 1990. This is a rate of 1.5% per year. And then increase to 84.3 quads in 1995, up

4.9%, or about 1% per year.

Oil's share of total energy for total market economies is forecast to fall from 45% in 1985 to 42.5% in 1990 and 40.3% in 1995. The natural gas share is projected to move up from 19.2% in 1985 to 20.5% in 1990 and 21.6% in 1995. Coal's share would change from 21.4% in 1985 to 21.3% in 1990 to 21.8% in 1995. Oil consumption in the market economies is projected by EIA to increase to 48 million b/d in 1990 from 45.6 million b/d by 1995. U.S. consumption is forecast to increase from 15.7 million b/d in 1985 to 16.1 million b/d in 1990 and 16.5 million b/d in 1995.

Oil's share of the energy market is expected to fall steadily according to EIA.

Total production in the U.S. is forecast to drop to 10.4 million b/d in 1990 and 8.8 million b/d in 1995. This is down from 11.1 million b/d in 1985. In this forecast, EIA defines total production as crude oil, NGL, other hydrocarbons and refinery gains. This is a drop in U.S. domestic production of 20% by 1995.

OPEC production is forecast to increase from 17 million b/d in 1985 to 20.4 million b/d in 1990 and 24.4 million b/d in 1995.

The Institute of Energy Economics—Japan

The Institute of Energy Economics in Japan made a simulation study to determine the impact of different oil prices on the world economy and world energy demand. A summary of the results appeared in the *Japan Petroleum & Energy Weekly*, dated June 23, 1986.

Following is a brief summary of the results of the study for $25/bbl oil and $15/bbl oil. This study shows the projected impact on growth through 1995 for the whole free world. Prices are in 1986 dollars.

At $25/bbl, the GNP growth rate was 2.7% per year and energy demand 2.0%. Oil demand would grow at 1.1% per year. Oil demand would increase to 48.2 million b/d by 1990 and to 51 million b/d by 1995. This is up from 45.6 million b/d in 1985. At $25/bbl, non-OPEC supply would drop only marginally from 28.4 million b/d in 1985 to 28.2 million b/d in 1990 and 1995. OPEC supply would increase from 17.2 million b/d in 1985 to 20 million b/d in 1990 and 22.8 million b/d in 1995.

Lower oil prices will stimulate economic growth and oil demand.

In contrast, at $15/bbl the economic growth rate would be 3.2% per year, the energy growth 2.6%. Oil demand would move up at an annual rate of 2.4%. By 1990, free world oil demand would be 51.6 million b/d, and by 1995 57.7 million b/d. By 1995, demand would be 6.7 million b/d higher, 13.1%, than with $25/bbl oil. Non-OPEC supply would fall to 24.3 million b/d in 1990 and down to 21.3 million b/d in 1995.

As a result, the OPEC supply requirement would increase rapidly to 27.3 million b/d in 1990 and up to 36.4 million b/d by 1995. Demand for OPEC oil in 1995 would be 59.6% higher with $15/bbl oil than with $25/bbl oil.